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Level Tracer K2001

200 to 4000 Hz

Technical Manual

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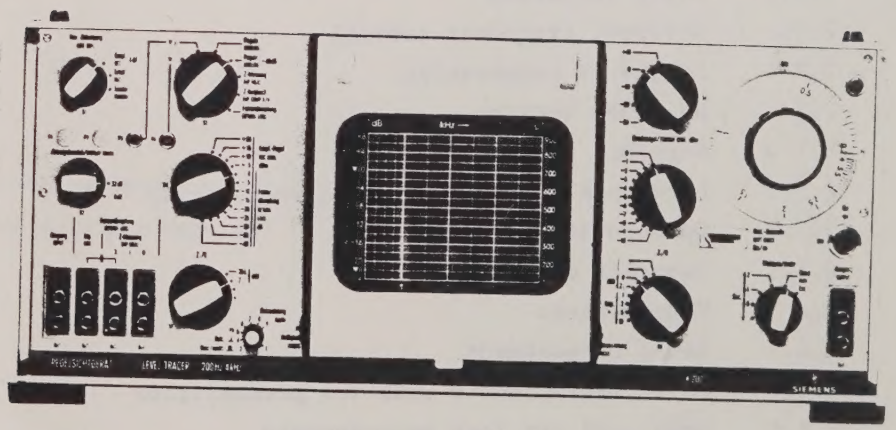


1. DESCRIPTION

K2001

1.1 Application

The level tracer K2001 is a complete test setup with signal generator and receiver for the VF range. The measured values are indicated as a function of the frequency on the long-persistence screen of a cathode-ray tube. The evaluation of the measured curve is effected with the aid of a calibrated graticule placed immediately in front of the screen. The result is thus immediately available as a continuous curve, which is an advantage of the sweep measuring method compared with point-by-point measurement. As a result of the short measuring times the level tracer is particularly suitable for series of measurements. A uniform grid is used for level and impedance measurements; the applicable scale is indicated in each case by a lamp. The reading is therefore always unambiguous even in the case of photographic recording, for which there is provision for additional illumination of the graticule.

The frequency range extends from 200 to 4000 Hz, so that the edges of the VF band (300 to 3400 Hz) can be tested and supervised without disturbing the neighboring channel, which is important for series of measurements in the VF channels of carrier frequency transmission equipment. In addition, the generator voltage can be suppressed in the response range of the inband signaling receivers, so that these do not respond when measurements are being made. The frequency can be either swept continuously or set manually point by point.

The receiver section obtains the voltage for frequency-dependent horizontal deflection either directly from the generator or derives it from the frequency of the voltage to be measured. For measurements on telephone channels it can therefore operate in conjunction with a second level tracer K2001 at the remote end. It is then possible to add a frequency marker to the display at the receiving end.

Measurements are also possible on two-terminal networks by means of built-in supplementary circuits: this allows impedance and return loss measurements to be made.

With the level tracer K2001, therefore, equalizers of VF line amplifiers can be set in the shortest possible time, balancing networks can be determined, or fault location according to Küpfmüller carried out with the aid of the impedance curves.

Furthermore impedance comparison measurements are possible, the test item X being compared with a standard N. The curves are displayed in succession, one being produced during the forward sweep and the other during the return sweep: the long persistence of the cathode-ray tube facilitates the reading.

The cathode-ray tube camera B952 is particularly suitable for photographic recording of the test curves; it is hung in front of the tracer on the mounting hooks provided on the unit.

The operating voltages are supplied by a built-in power supply from ac line voltages of about 110 or 220 V. The unit is double insulated.

The unit can also be operated from an internal 12 V battery: the associated charging unit is incorporated in the power supply. In addition there is provision for the connection of an external battery with a terminal voltage between 12 and 48 V.

1.2 Electrical specifications

Frequency range: 200 to 4000 Hz

GENERATOR

Sweep rate adjustable:
2, 4, 8 seconds for forward and return sweeps and freely settable

Logarithmic frequency sweep

Manual frequency setting

Frequency setting accuracy ±3 % ±5 Hz

Frequency externally controllable

Output level: -40 to +10 dBm
settable in steps of 10 dB and 1 dB

Output level accuracy at 1000 Hz
with a load of Z=Zi or for Zi ∿ 0 Ω
with Z > 300 Ω: ± 0.2 dB

Frequency response, relative to 1000 Hz: ±0.1 dB

AC voltage variations of ± 10 %:
have no effect

Source impedance: ∿ 0 Ω
settable to: 600 Ω and 900 Ω

Unbalance ratio: > 40 dB

Harmonic ratio with termination > 300 Ω: > 40 dB

Only when equipped with K 3010 (optional)

Generator frequency suppression for inband signaling:
settable to 2.6 kHz or 3.0 kHz (and settable as required)

Frequency marker: continuously adjustable

Frequency marker accuracy: ± 3 % ± 5 Hz

RECEIVER

Level measuring ranges,
relative to the 0 dB line: -40 to +20 dBm
settable in steps of 5 dB

Smallest measurable level: -50 dB
Smallest readable level: -64 dBm

Evaluation of the measured voltage: approx. rms

Scale range: +8 to -24 dB

Expansion of level indication
Scale range +2 to -6 dB

Scale: linear level graduations

Scale graduation accuracy
from +2 to -6 dB: < 0.2 dB

Measuring accuracy (ordinate) at 1000 Hz
relative to the 0 dB line on the 0 dBm range:
±0.2 dB

Attenuator accuracy: ±0.1 dB

Frequency-dependence of the indication,
referred to 1000 Hz and the 0 dB line: ±0.1 dB

Voltage variations of ± 10 % have no effect

Accuracy of frequency indication
(abscissa): ±5 % ±10 Hz

Scale graduation for frequency indication: approx. linear

Input circuit: floating, balanced

Input impedance: 30 kΩ
settable to: 600Ω and 900Ω

Unbalance ratio: > 40 dB

Withstand voltage with high impedance input:
60 V dc: 100 V/25 Hz ringing voltage

Display size, length of ordinate: about 70 mm
length of abscissa: about 85 mm

Only when equipped with K3010 (optional)

Extension of the level measuring range
to -80 to +20 dBm, relative to the 0 dB line

Level measuring range without preamplifier
relative to the 0 dB: -40 to +20 dBm
see above!

Level measuring range with preamplifier
(e.g. for crosstalk measurements)
relative to the 0 dB line: -80 to -20 dBm

Settable in steps of: 5 dB

Smallest measurable level: -90 dBm
Smallest readable level: -104 dBm

Measuring accuracy (ordinate) at 1000 Hz
relative to the 0 dB line on the -40 dBm range
±0.5 dB

Attenuator accuracy: ±0.1 dB

Frequency dependence of the indication,
referred to 1000 Hz and the 0 dB line: ±0.2 dB

See above for other data!

Impedance measurements

Measuring range: 100 Ω to 9 kΩ

Scale range: 100 Ω to 900 Ω
Scale factor, switchable: x1, x2, x5, x10

Measuring accuracy
in the range from 100 Ω to 2 kΩ: ±5 %
in the range from 2 kΩ to 4 kΩ: ±10 %
in the range from 4 kΩ to 9 kΩ: ±20 %

Impedance comparison measurements

N X alternate-presentation: two-pole changeover

For data see impedance measurement

Effective return loss measurement

Measuring range, relative to the 0 dB line:
0 to 40 dB
largest readable attenuation: 64 dB

Measuring accuracy
for X and N between 200 and 6000 Ω
referred to the 0 dB line: ±1 dB

Recorder outputs

Y-output: 0.5 to 4.5 V
admissable note resistance >10 kΩ

X-output: 0.2 to 4.0 V
admissable note resistance >1 MΩ

Power requirements

AC power connection, double insulated: 110 to 130 V,
220 to 240 V ±10 %; 47 to 63 Hz, about 10 VA

Battery connection without changeover:
12 to 48 V

Current drawn at 12 V: about 800 mA
grounded terminal: as required

Battery charging circuit: built-in

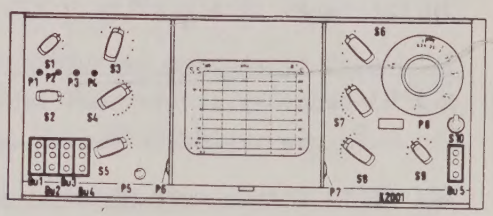
Suitable batteries: two 6 V Ni-Cd batteries

Battery voltage: 12 V

Continuous operation: about 8 hours

1.3 Mode of operation

The level tracer K2001 contains the signal generator and receiver for measurements on four-terminal and two-terminal networks. The measured values appear on the screen as a frequency-dependent curve and can be read directly with the aid of the calibrated graticule.

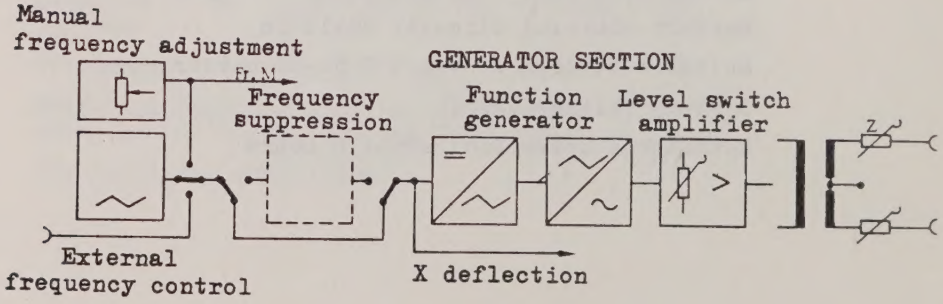


The frequency range of the level tracer extends from 200 to 4000 Hz and thus covers that of the telephone channel (300 to 3400 Hz) with a good margin.

In accordance with its electrical and mechanical design the level tracer K2001 can be divided into the following units:
Generator section, receiver section, control panel as the front module, display section and power supply.

1.3.1 Generator section

The frequency of the generator is produced in a so-called function generator; it is proportional to the applied voltage.



Frequency setting

Manual setting

A dc voltage corresponding to the required frequency is set with potentiometer P8. The stabilized feed voltages are taken from the +9 V and -9 V supplies. The precision potentiometer is linear; however as a result of the circuit an almost logarithmic frequency response as a function of the angle of rotation results. This results in accurate frequency setting even at lower frequencies. The large handy knob on potentiometer P8 incorporates the dial with the frequency scale.

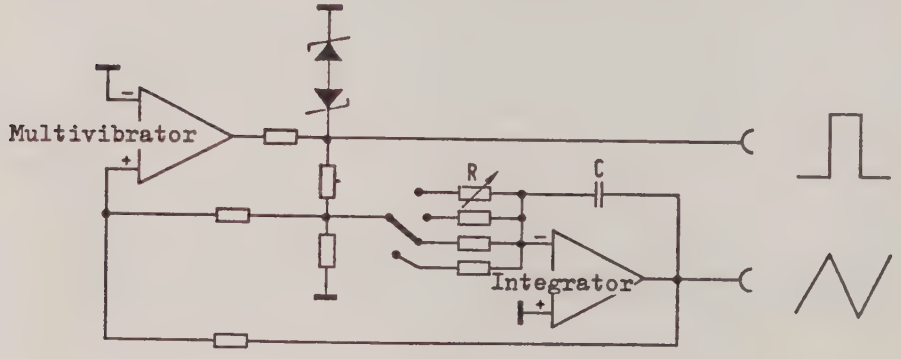
Sweep operation

For sweep operation the potentiometer is replaced by the sweep generator.

The sweep generator

The triangular-wave generator comprises two operational amplifiers which operate as a flip-flop and an integrator.

Assuming the multivibrator is delivering a negative voltage, the following integrator supplies a continually rising output voltage. A differential voltage obtained from the two voltages is applied to the non-investing input of the first operational amplifier. As soon as the sign of the differential voltage changes (upper threshold) the multivibrator is switched to produce the positive output voltage. The integrator then delivers a continually falling voltage, until the sign of the differential voltage changes again (lower threshold) and the multivibrator delivers a negative output voltage.

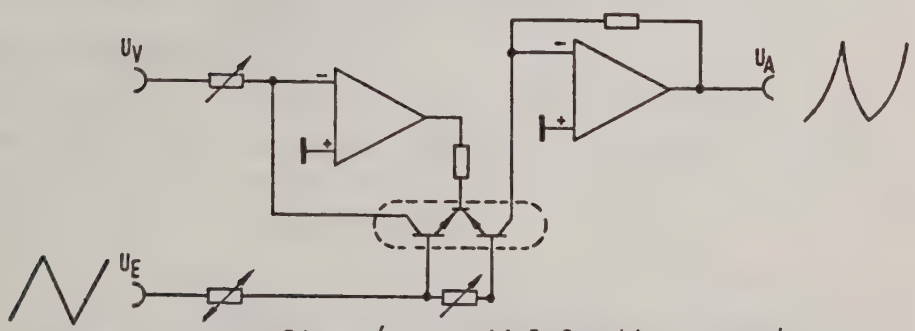


Sweep generator

A square wave is therefore present at the output of the multivibrator and a triangular wave at the output of the integrator, the two being synchronized. Their frequency determines the sweep rate and is set by means of the time constant RC. The times 2, 4 and 8 seconds are preset for the forward and return sweeps; another position is provided for the user to set the time himself, and this can be between 1 and 25 seconds.

While the square wave is available for X-N transfer, the triangular wave is further processed for frequency generation.

As a logarithmic frequency characteristic is required and the frequency is exactly proportional to the applied voltage, the triangular wave must be exponentially distorted. This is effected in the "linear/exponential function converter". The straight edge of the triangular wave is converted to an exponentially increasing curve. The logarithmic dependence of the collector current of a transistor on the emitter-base voltage is used for this purpose. The temperature dependence of the transistor is compensated by a second transistor in the same case and by a temperature-dependent resistor in the circuit.

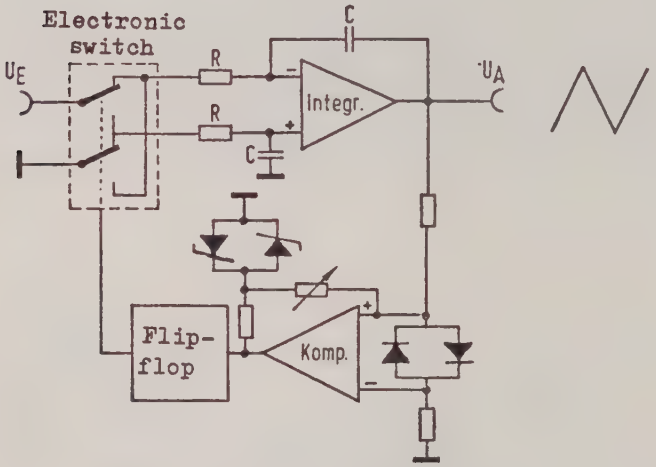


Linear/exponential function converter

This exponentially rising and falling voltage, the sweep voltage, is applied to the function generator.

The function generator

The function generator produces the generator frequency proportional to the applied dc voltage. If a sweep voltage is applied, a swept frequency is produced.
The output voltage has a triangular-wave form.
The following illustration shows the basic circuit of the function generator.



Function generator

The frequency-determining input voltage V_E is applied alternately to the inverting and non-inverting inputs of the integrator via an electronic switch. The voltage at the integrator output increases in the one case and decreases in the other. The changeover points are determined by the subsequent comparator in whose circuit two reference voltages are formed. When these reference voltages are reached the flip-flop causes the electronic switch at the integrator input to transfer. A triangular voltage waveform is thus produced at its output.

The higher the applied input voltage, the quicker the changeover point is reached and the higher the frequency. The frequency is exactly proportional to the applied voltage. In the case of sweep operation the frequency follows the instantaneous value of the sweep voltage. The small transient time of the function generator permits rapid sweeping and allows the generator frequency to be changed suddenly.

The "output amplifier" module also accommodates the

Triangular-sinusoidal conversion circuit

The triangular voltage supplied by the function generator is converted to a sinusoidal voltage in a diode-resistor network. The latter functions as a six-stage amplitude-dependent voltage divider and operates symmetrically with respect to zero voltage. As the voltage (peak-to-peak) of the triangular waveform is constant, irrespective of the frequency, a fixed network can be used.
The distortion factor of the sinusoidal voltage is less than 1 %.

Level setting and output circuit

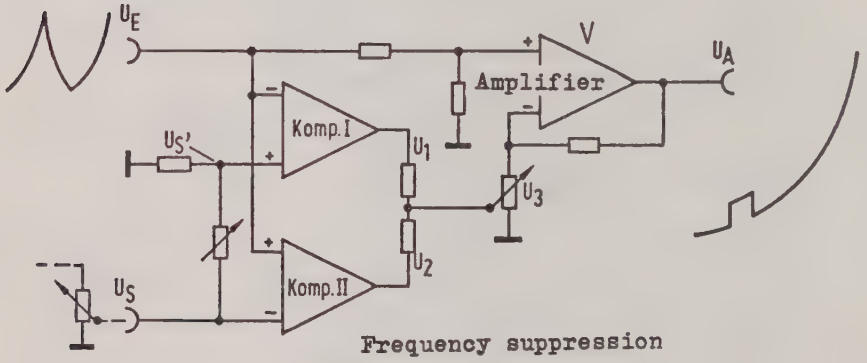
The output level is set in steps of 10 dB and 1 dB via two resistive attenuators, which are isolated from the diode network (sine-wave converter)by an impedance converter. The signal is fed to the output transformer via the output amplifier.

The amplifier incorporates a changeover circuit for correcting the output level in accordance with the calibration of the unit in power or voltage levels. The signal arrives amplified at the output transformer and, depending on the measurement required, is applied to the output jacks either directly or via the impedance-setting resistors. These resistors are looped equally into the a and b wires by means of switch S8. The level indicated at the level switches S6 and S7 applies to the terminated output terminals. If the output is operated at low impedance (Zi 0 Ω) a 6 dB lower level is taken from the output transformer. The output level then conforms again (when R > 300 Ω) with the value indicated at the level switch. In addition the high-value resistors necessary for the impedance measurement are switched by means of impedance switch S8; the specimen (a two-terminal network) is supplied with a constant current via these resistors. The secondary

of the output transformer is symmetrical and is used as a "balancing choke" in the bridge circuit for the return loss measurement.

Frequency suppression (optional)

For measurements on voice channels which are equipped with inband signaling, the swept frequency can cause the selective inband signaling receiver to operate. In order to avoid this, a module has been designed to suppress adjustable narrow frequency bands. The sweep voltage is applied via the operational amplifier V, in which a voltage step with adjustable amplitude and width is superimposed on the sweep voltage.

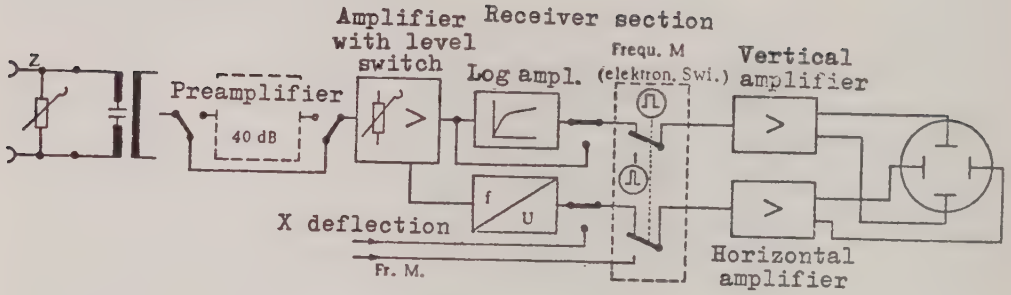


Frequency suppression

At the input to which the sweep voltage V_E is applied the inputs of two comparators are connected in phase opposition. The two other inputs of the comparators are connected to two adjustable dc voltages V_S and $V_S/$, which correspond to the limits of the frequency range to be suppressed. The output voltages V_1 and V_2 of the two comparators produce an additional dc voltage V_3 at the inverting input of the amplifier V via a divider, while the input voltage V_E sweeps the interval to be suppressed. After the V/f conversion the output frequency experiences a frequency jump and

the required range is thus suppressed. Provision is made for two stop bands which can be selected by means of switch S11 (at the rear); the bands are set with three potentiometers; see operating instructions.

1.3.2 Receiver section



Input circuit

The test level arrives at the balanced input transformer via the input jacks. Terminating resistors can be added or the input can be switched to high impedance (≥ 25 kΩ) by means of impedance switch S5. For measurements with an input sensitivity of -40 to -80 dBm for full-scale deflection a preamplifier (optional) with a gain of 40 dB can be connected after the transformer, if required; this enables a level of -104 dBm to be read. This is important for crosstalk measurements. The preamplifier also incorporates a low-pass filter for bandwidth limitation.

The preamplifier is followed by a high impedance attenuator S4 variable in 5db steps. This enables the sensitivity for full-scale deflection to be varied between -40 and +20 dBm without a pre-amplifier and between -80 and -20 dBm with a preamplifier.

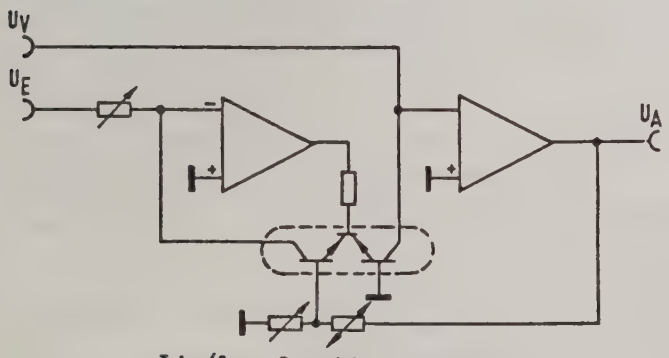
Amplification and specification

The signal is amplified in the wide-band amplifier and adapted to the calibration in voltage or power levels. After the first amplifier stage a voltage is branched off for obtaining the horizontal deflection voltage; (see below). From this point the signal is evaluated separately in two branches: for vertical and horizontal deflection of the electron beam.

Vertical deflection. The signal is further amplified and rectified. Two antiparallel diodes in the feedback path of the second amplifier stage compensate the threshold voltage of the rectifier diodes and ensure linear rectification over a dynamic range of 32 dB. The rectifiers operate in a doubler circuit with a quasi-rms characteristic.

The rectified and smoothed signal voltage is further amplified in a third stage and applied to the following logarithmic amplifier module.

An operational amplifier with negative feedback via a transistor supplies the logarithmic characteristic.



Lin/log function converter

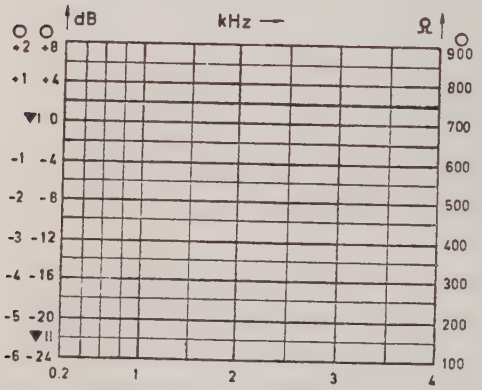
A second transistor (in the same case), via which the other amplifier is coupled, together with a temperature-dependent resistor, provide compensation for the effects of temperature.

The conversion of the linear voltage values to proportional logarithmic values results in a linear level scale which has the following advantages: uniform resolution over the whole of the scale range, easier interpolation between the scale divisions, the scale division remains valid if the display is extended; it is also suitable for resistance indication.

Careful alignment of the logarithmic amplifier and the calibration procedures ▼ I (0 dB-line) and ▼ II (-22dB-line) produce high measuring accuracy over the whole of the scale range when level measurements are carried out.

The signal voltage is applied to the vertical amplifier via the "Frequency marker" module, discussed below. (The vertical amplifier is incorporated in the converter module K5107).

The vertical amplifier amplifies the signal so that a change of 32 dB in the level gives rise to a vertical beam displacement over the whole scale. With switch S2 in a second position the gain of the vertical amplifier is increased so that a level range of 8 dB fills the scale, which corresponds to a vertical expansion by a factor of 4. Two sets of values are given on the left-hand side of the scale, one for normal and the other for expanded display; the appropriate set is marked by a lamp in each case. This facilitates the reading which is always unambiguous.



The vertical amplifier also incorporates potentiometers P4 and P3 for calibrating the level indications▼I and▼II. The setting of the potentiometers is described in section 2.3.2 (calibration) of the operating instructions.

Horizontal deflection:

Frequency-voltage conversion

For loop measurements the deflection voltage for the horizontal deflection of the electron beam can be taken directly from the input voltage to the V/f converter in the generator section.

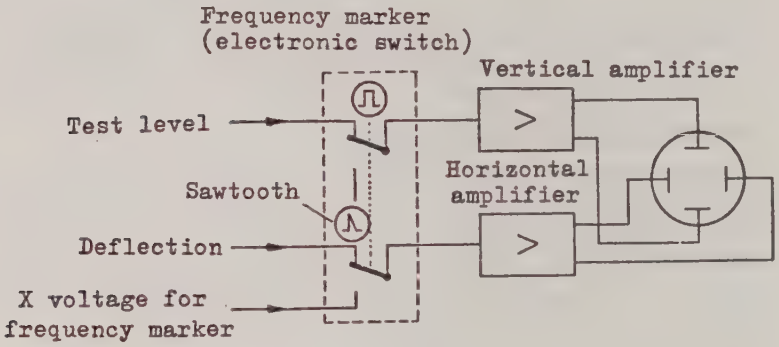
For measurements at the remote end of the line a dc voltage proportional to the received frequency is derived by means of an f/V converter. For this purpose the sinusoidal output voltage of the first amplifier stage is converted to a square wave by means of a Schmitt trigger and then differentiated. The pulses thus formed are fed to an integrating amplifier.

A dc voltage proportional to the frequency is produced at its output and the dc voltage corresponds to the sweep voltage at the sending end; it is amplified in the horizontal amplifier for the horizontal deflection in the cathode ray tube. The horizontal deflection for the frequencies 200 Hz and 4 kHz by means of the two potentiometers P1 and P2 in the horizontal amplifier: see operating instruction 2.3.2 calibration. (The amplifier is located in the high voltage converter module K 5106).

Frequency marker (optional)

If the frequency-voltage converter is used, i.e. the horizontal deflection is derived from the received frequency, a frequency marker can be added to the display as a vertical line. The accuracy of the frequency indication from the generator can thus be checked and the frequency of important test points, e.g. the center frequency of a narrow filter, can be accurately determined.

The frequency marker module consists mainly of an electronic switch with a controlling multivibrator.



In the inoperative condition (without frequency marker) the line to the horizontal deflection and the line to the vertical deflection are switched through; the condition described above exists and the frequency marker module therefore has no effect.

If the frequency marker is activated the display of the test curve is interrupted in step with the multivibrator and the frequency marker is displayed in the following way.

At the moment of changeover the voltage of the generator frequency (X voltage) set manually is applied to the horizontal branch; the electron beam is deflected horizontally in accordance with the set frequency. A sawtooth voltage is applied to the vertical branch by the multivibrator, which deflects the beam vertically across the screen and thus generates the frequency marker. Besides the sawtooth voltage for the vertical deflection the multivibrator also supplies a square wave for the electronic switch. The switching frequency is about 150 Hz.

Recorder outputs

A signal voltage is branched off before the vertical amplifier and applied to contact a3 of the 20 contact jack J8. A recorder with an input impedance of >10 kΩ can be connected to this contact; output voltage 0.5 to 4.5 V. As the signal is branched off following the logarithmic amplifier, a linear level scale is also obtained at the recorder e.g. 32 dB for 8 cm calibrated width. The expansion of the display on the screen has no influence on the recorder.

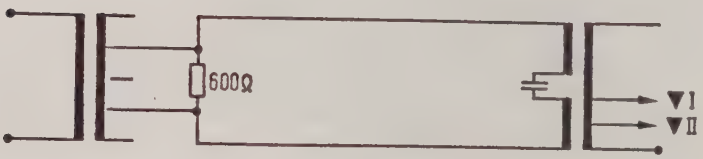
The horizontal deflection voltage is applied to contact b3 (ground to b2) of jack Bu8. Output voltage 0.2 to 4 V; load resistance >1 MΩ. An X-Y recorder can be connected to the two outputs.

The cathode-ray tube (type D13-41 GM) has a flat screen of 13 cm diameter with long persistence. The utilized screen area is 70 x 85 mm. The transparent scale is immediately in front of the screen; the grid and the numerical values are in white and can be illuminated for photographic recording. For documentation of the test results the test curve including the grid and the range indication can be photographed with the CRT camera B 952. Mounting hooks for the camera are incorporated in the unit.

1.3.3 Functions of the control panel

The various operating modes are selected with switch S3. The necessary switching conditions, which are different in each individual case, are established via switch and relay contacts.

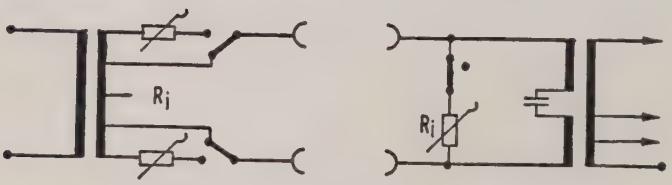
1. Calibration ▼I, ▼II



Calibration

The calibration level is taken from the 10 dB attenuator (generator section) and fed directly to the amplifier. The level switch position has no effect. The calibration voltage is fed to the receiver section via special taps at the output transformer. It is amplified and displayed on the screen, by-passing the additional amplifier and the level switch. When calibrating ▼ I, 0 dB, calibration can be carried out with normal display as well as with expanded display. All the other switches have no effect and can be set to any positions during calibration. When calibrating ▼ II, only the level at the input transformer is reduced. Expanded display is then not possible.

2. Level measurement, level measurement -40 dB



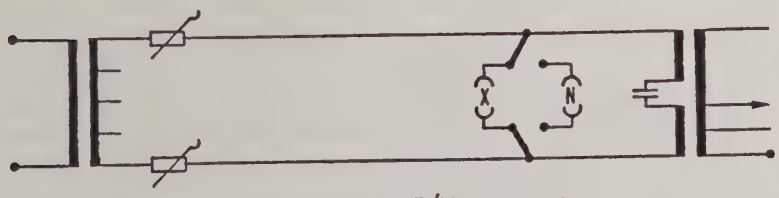
Level measurement, level measurement -40 dB

All the switches are operative when carrying out level measurements. The output level and the output impedance on the generator section and the sensitivity and the input impedance on the receiver section must be set. Measurement is carried out with normal or expanded display; horizontal deflection from the receiver or generator section as required.

For the measurement of small received levels, -40 to -80 dBm, the preamplifier must be cut in with S3 in position "level measurement -40 dB". The 40 dB gain must be added to the level values read off the graticule.

Connect the test item to the "output" and "input" jacks.

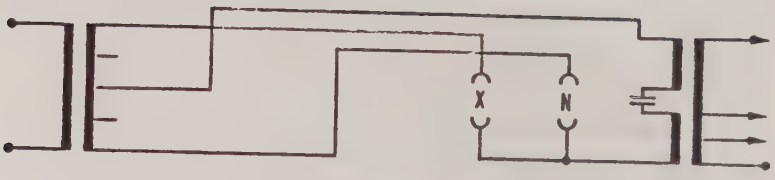
3. Impedance, impedance comparison X/N



Impedance measurement; X/N comparison

Connect the test item to jack X, and to jacks X and N if a comparison is being made.
The measurement is carried out with a constant current; the series resistors are cut-in by switch S8 and this simultaneously sets the measuring range. The level switches on the generator and receiver sections, and the expansion switch and impedance switch on the receiver section have no effect.
During impedance comparison measurement the response is traced out during the forward sweep and that of N during the return sweep.

4. Return loss



Return loss

For return loss measurements the symmetry of the output transformer is utilized; its secondary winding forms one side of the bridge circuit, the balancing network (at jack N) and the line to be balanced (at jack X) form the other side of the bridge.

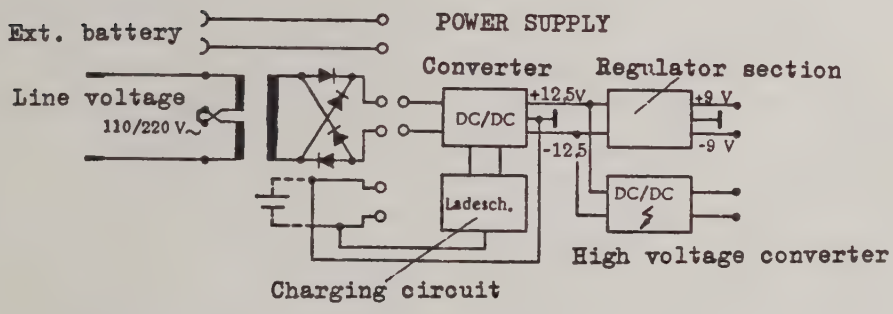
If the ringing signal blocking capacitors on the line side cannot be included with the line, they can be replaced by the built-in capacitor (2 µF); the line must then be connected to the jack "Line". The output level is +6 dB with Ri ~ 0 Ω and a level of approximately "zero" appears at the test item. The output voltage of the bridge circuit is a measure of the return loss, the exact received level gives the return loss directly with opposite sign.

1.3.4 Power supply

As a multi-purpose test set for the laboratory and test shop and for transmission routes, the level tracer is well equipped with regard to power supplies. The unit is designed for operation from 110/220 V ac networks. The line voltage connection is double insulated.

In addition a battery (2 x 6 V) can be used; an associated battery charger is incorporated in the unit. An external battery can also be connected; permissible battery voltage 12 to 48 V.

The power supply section contains the following circuit elements: line voltage connection with power transformer and rectifier, converter high voltage converter, regulator section and charging circuit.



The converter receives its input voltage either from the power rectifier or from the internal or external battery. It processes input voltages between 11 and 50 V and delivers an output voltage of ± 12.5 V.

The variations of the converter output voltage are limited to ±2 % by an internal regulator circuit. This is stable enough for the majority of modules to be supplied.

The succeeding high voltage converter does not therefore have its own regulation circuit; in particular it generates the voltages for the cathode-ray tube.

The regulator section supplies the stabilized voltage of ± 9 V with a maximum fluctuation of ± 0.5 % for accurate reference voltages and for the offset adjustment of the operational amplifiers.

The charging circuit enables the battery incorporated in the unit to be recharged. To avoid overcharging the battery, the discharge time and thus the energy used is measured with an E cell. Recharging is then automatically limited to a value which takes into account the discharge and the efficiency of the battery.

The charge of the E cell must be coordinated with the charge of the battery after the latter has been fitted, see Section 2.1.3 of the operating instructions.

1.4 Designations, dimensions and weights

Description	Order No.	Dimensions in mm	Approx. weight in kg
Level tracer K2001 200 Hz to 4000 Hz	S45034-K2001-A202	448x195x445	15
Accessories			
1 power cord	V45594-F4-A222	1600	0.3
1 battery cord	V45257-R3010		
2 lamps	C30230-F62-A6 (Fg Lp 62 f)		
2 fuse links 0.125 A	D41571-M125-C2		
2 fuse links 0.25 A	D41571-M250-C2		
As required:			
1 modification set	S44034-K3010-A701	-	0.5
comprising the following modules:			
1 frequency suppression	S45035-K5102-A701		
1 supplementary amplifier	S45035-K5095-A101		
1 frequency marker	S45035-K5104-A701		
2 batteries, 6 V	C44153-Z2-C4		
Balanced connecting cord with 2 three-pin plugs	V42255-R15-A...	500...2000	0.2
Balanced connecting cord with 1 three-pin and 3 single-pin plugs	V42255-R6-J...	1000...3000	0.2
1 cathode-ray tube camera B952	see data sheet B 1002		

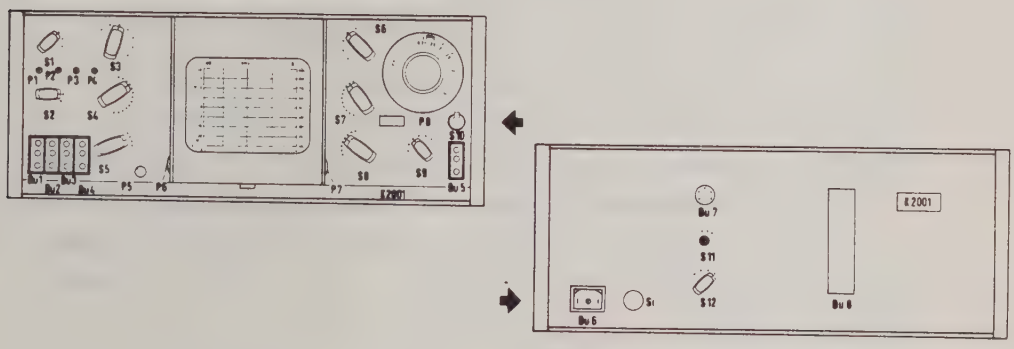
2. OPERATING INSTRUCTIONS

K2001

2.1 Putting into operation

The unit is designed for three different power sources.
It is always actuated with switch S10.

2.1.1 Operation from ac power line



The unit is designed for operation from ac power lines and is double insulated in accordance with German (VDE) safety regulations. For uniformity a three-wire power cord is used, but the non-fused ground conductor is not connected to the unit.

If the power plug has to be replaced by another (suitable for the locality), it is recommended that the ground connector be re-connected so that the power cord remains suitable for general use.

Connection of wires: yellow-green wire to the ground conductor terminal
blue and black wires to the live terminals.
Set switch S12 (at the rear) to "AC". The unit can be matched to various line voltages by means of the voltage selector switch.

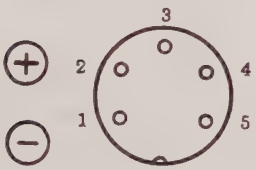
The voltage selector switch is located in ac power connector Bu6 (rear) and is accessible when the power cord is removed. It has two positions and must be in the "110 V" position for line voltages between 98 and 140 V and in the "220 V" position for voltages between 198 and 264 V.

The nominal value of the fuse is 0.25 A for the "110 V" position and 0.125 A for the "220 V" position. There are spare fuses in the spare parts bag inside the unit.

When they leave the factory the units are set for a line voltage of 220 V. Before putting the level tracer into operation for the first time it is advisable to check that the voltage selector switch is in the correct position for the conditions pertaining in the locality.

2.1.2 Operation from an external battery

Set switch S12 (at the rear) to "BATT EXT".
Permissible battery voltage 12 V to 48 V
Current load about 800 mA at 12 V.
Connections to battery connector J7 (rear)
+ terminal to pin 2, - terminal to pin 1; grounded terminal as required.



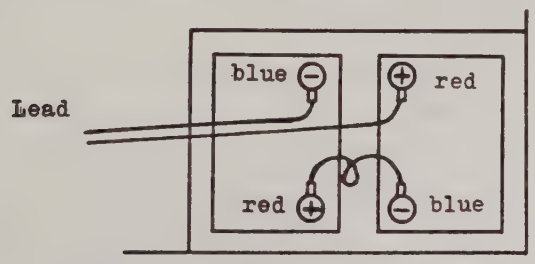
Battery connector J 7

2.1.3 Operation from a built-in battery

Mounting: Remove the knob from switch S12 and then take off the rear panel and the upper cover plate. When viewing from the rear the battery compartment is on the right-hand side.

First loosen the two screws with the rubber buffers and the upper mounting brackets. Then insert the two batteries as shown in the sketch and clamp them in place with the holding bracket and rubber buffers.

Connect the leads, the red lead to the positive terminal (red), the blue to the negative terminal (blue), also interconnect the two free terminals (+ and -).



The short interconnecting wire is in the spare parts bag inside the unit.

Set switch S12 (rear) to "BATT INT". When the level tracer is switched on, the small meter indicates the charge condition of the battery. The charge is adequate as long as the deflection remains in the green sector. The ac power cord must not be plugged in during battery operation. It must be plugged in, however, if the battery is to be charged. For this set switch S12 to the "BATT CHARGE" position. Charging takes about 14 hours.

Note! If the batteries are removed, the leads must be connected to the plug distributer.

Setting the E cell

If a new battery is inserted the charge condition of the battery must first be matched to that of the E cell. This is carried out as follows:

1. Switch off switch S on the module "Charging circuit" K5099, i.e. switch to position "2".
2. Charge the battery for 16 hours.
   (The initial charge condition of the battery is unimportant)
   Connect the unit to the power line and set switch S12 (rear) to "BATT CHARGE" position.

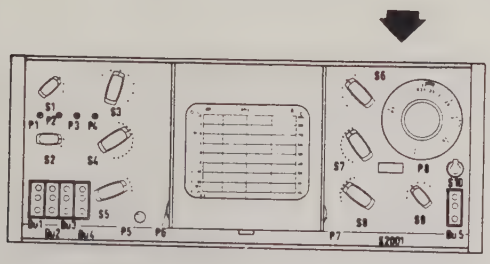
3. Terminate charging after 16 hours, i.e. set switch S12 (rear to "BATT INT" and reactivate switch S on module K5099, position "1".

After this charging process the battery is definitely fully charged and the E cell set to this condition.

It is almost a certainty that the above procedure will have to be repeated in the course of time if only due to the self-discharge of the battery in the quiescent condition.

2.2 Generator section

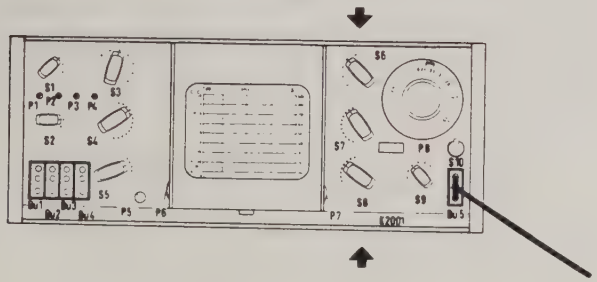
The generator section controls are located to the right of the cathode-ray tube.



2.2.0 General

The output level is taken from jack Bu5; the generator cable with the three-pin plug is inserted here.

The impedance of the output circuit is set with switch S8, 600 Ω or 900 Ω or ∼ 0 Ω.



The output level is set with the two attenuator switches S6 and S7, which are marked in level values.

Control range:

S6 in steps of 10 dB; + 10 to -30 dBm

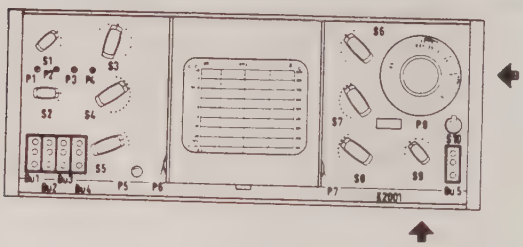
S7 in steps of 1 dB; 0 to -10 dBm

The level value indicated applies at output jack Bu5 with a termination Ri = Z_a, or for Ri ∼ 0 Ω with termination > 300 Ω.

2.2.1 Manual frequency setting

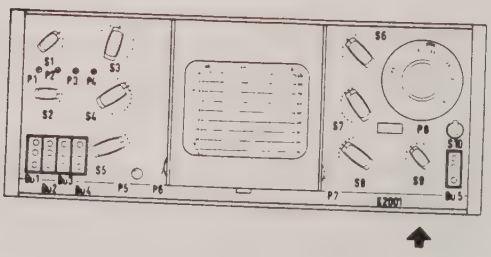
Set switch S9 to "MAN"

Set the required frequency on the circular scale with potentiometer P8.



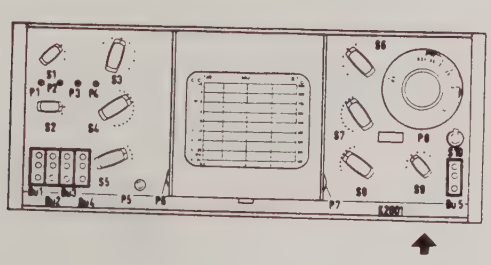
2.2.2 Sweep operation

Set switch S9 to sweep operation, "SWEEP 2,4,8 sec" and select the sweep rate; 2, 4 or 8 seconds for forward and return sweep. In addition another switch position is provided for which the user can set the sweep rate himself. The circuit is located on module K5103 (sweep generator); the sweep rate is set by turning potentiometer R8, accessible from above. Setting range: about 1 s to 25 s for forward and return sweep.

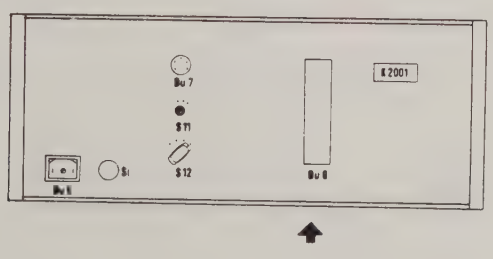


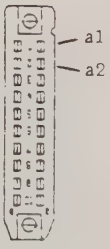
2.2.3 External frequency control

With switch S9 set to position "EXT", the frequency or frequency sweep can be controlled externally.



The control voltage is applied to contacts a1 and a2 (ground) of jack Bu8. + terminal to a1. A voltage of 0.2 to 4 V generates a frequency of 0.2 to 4 kHz.
In the same way a triangular or sinusoidal voltage of 0.2 to 4 V peak to peak can be applied and thus the frequency can be swept externally.
For this the period of the applied sweep voltage shall be $\geq$ 1 s.



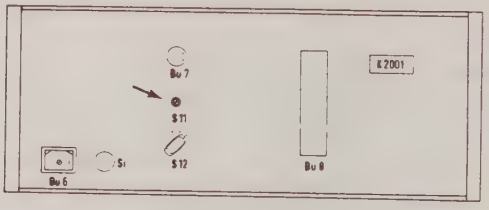


Jack Bu8

2.2.4 Frequency suppression

(Only if the device is equipped with the modification set K3010. Optional.)
The inband signaling receiver must be prevented from operating when measurements are made over the VF line. The critical frequency

is therefore suppressed. The units are equipped for inband signaling frequencies of 2.6 and 3.0 kHz; the frequency suppressor is selected by switch S11 (at the rear).

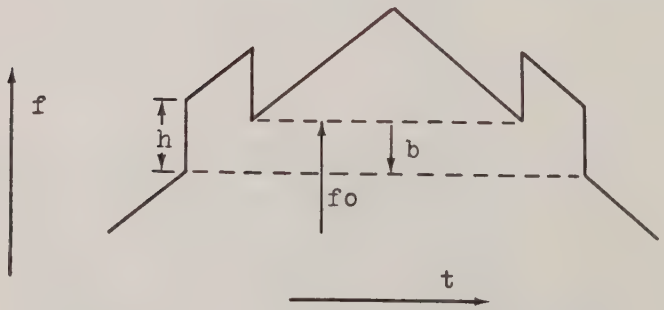


If required another stopband can be set with the three potentiometers on the "Frequency suppression" module K5102:

upper suppressed frequency (fo): with potentiometer R2 or R5 (depending on the position of switch S11)

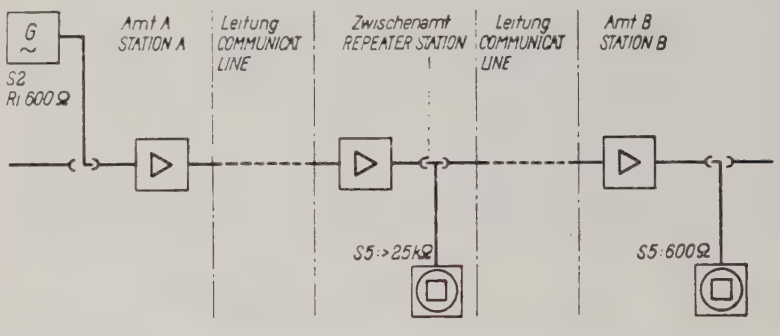
suppression bandwidth (b): with potentiometer R9

Height (h) of the voltage or frequency step with potentiometer R22.



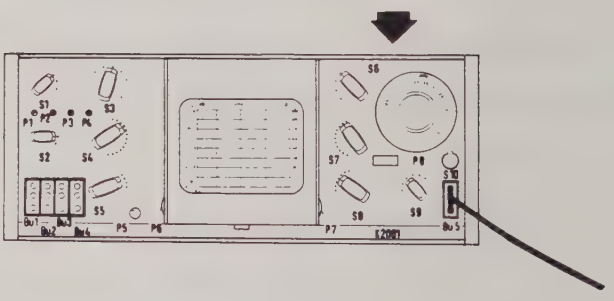
2.4.3 Level and net loss measurements

on a transmission path



Measurement on a transmission path with physically separated level tracers

Generator in station A



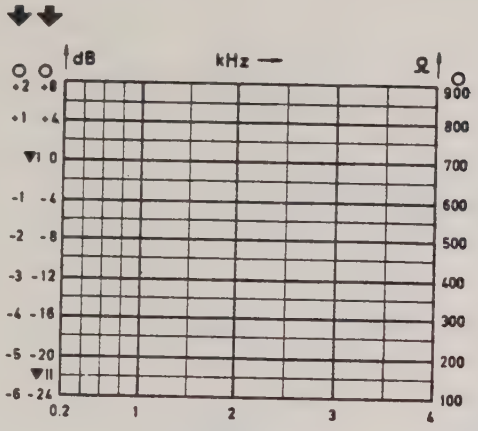
Connect transmission line to jack Bu5

S8: set impedance (600)

S6, S7: set output level (0 dBm)

S8: sweep rate

S11: suppress inband signaling frequency if necessary



Read the level values from the scale marked by a luminous indicator.

The absolute received level is the sum of the level values on sensitivity switch S4 and the screen scale.

2.4.2 Level measurements with the preamplifier

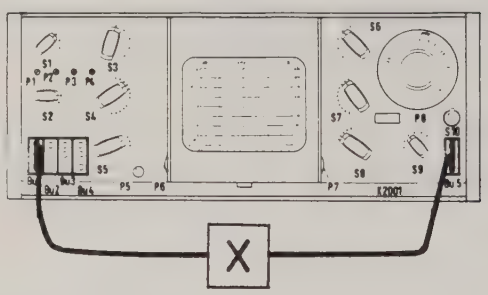
(Only if the unit is equipped with modification set K3010. Optional).

Set switch S3 to position "LEVELING - 40 dB"; the preamplifier is activated and increases the sensitivity by 40 dB. The absolute received level is now the sum of the level values on sensitivity switch S4 and the screen scale, minus 40 dB. Switch S4 can also be fully used with the preamplifier Switch S4 can also be fully used with the preamplifier cut in, so that a level measuring range of -20 to -80 dBm for the 0 dB line is obtained; the minimum readable level is -104 dB.

All further settings are as previously described in 2.4.1. The operating mode with increased sensitivity is principally intended for crosstalk measurements.

2.4 Measurements

2.4.1 Level measurement



Connect the test item to jacks Bu5 and Bu1.
Set switch S3 to "LEVELING" (level alignment).

Horizontal deflection from the generator: set S1 to "TRANSM".
Match the source impedance of the generator (~0, 600 and 900 Ω) to the test item with switch S8 and the input impedance of the receiver 600, 900 Ω with switch S5. If the test item is already terminated, set S5 to "> 25 kΩ".

Then set the sensitivity of the receiver with level switch S4 so that the test curve is as near to the 0 dB line as possible.

Select the display scale with switch S2;
Position "32 dB", normal display, scale range 32 dB
Position "8 dB", eypanded display, scale range 8 dB.

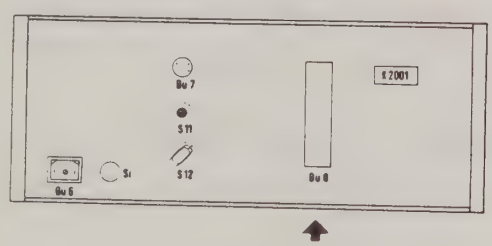
2.3.3 Recorder connection

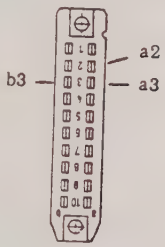
The deflection voltages for the vertical (Y) and horizontal (X) directions are brought out at jack Bu8. A voltage recorder for recording the level curve or an X-Y recorder can be connected at this point.

Connections:

for voltage recorder: positive to a3
negative to ground a2, b2

for X-Y recorder: Y: positive to a3
X: positive to b3
both negative terminals to ground, a2, b2

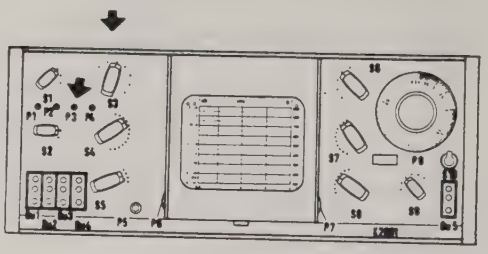




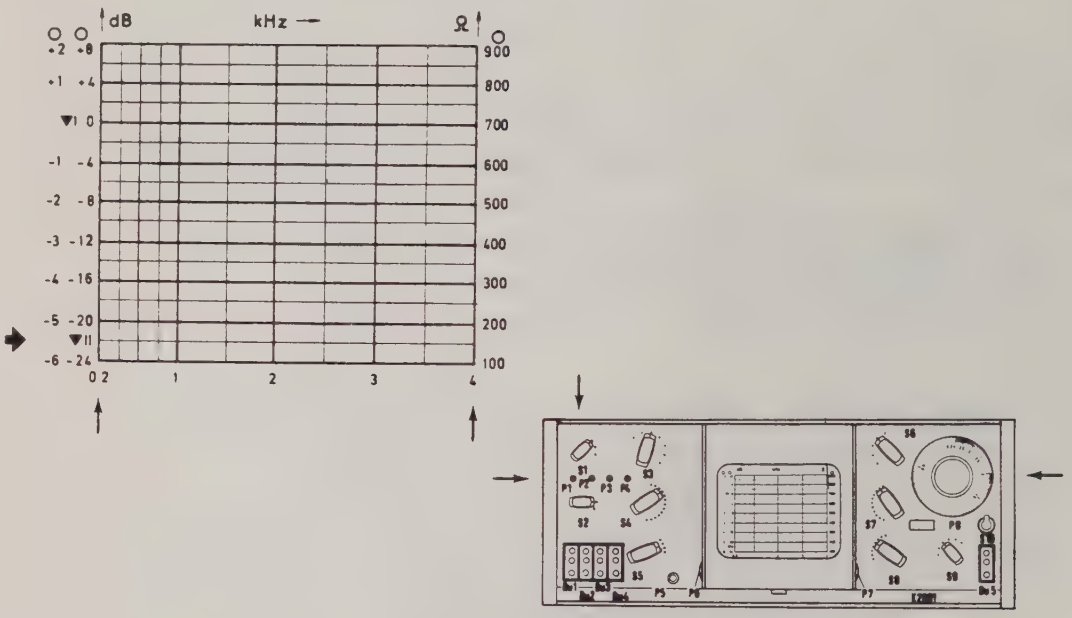
Jack Bu8

The deflection voltage for the Y deflection at the contacts of jack Bu8 varies between 0.5 V and 4.5 V and can be loaded with a recorder input impedance of 10 kΩ; the corresponding values for the X deflection are: 0.2 V to 4.0 V, permissible load impedance: ≥ 1 MΩ.

Set made of operation switch S3 to caibration ▼ II.



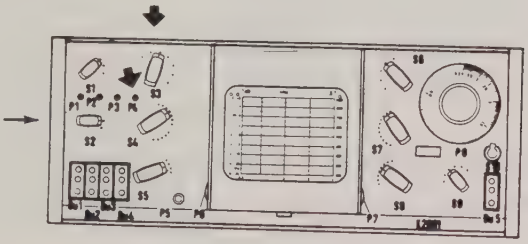
The trace should be on the -22 dB line; it can be adjusted with potentiometer ▼ II, P3. This terminates the calibration procedure for the vertical deflection.



Potentiometers P1 and P2 are used for correcting the horizontal deflection. Cut in the frequency marker with switch S1 and accurately set a frequency of 4 kHz with potentiometer P8. The frequency marker must then be aligned with the "4 kHz" grid line by means of potentiometer P2.
Then set P8 accurately to 0.2 kHz and align the frequency marker with the "0.2 kHz" grid line by means of potentiometer P1.

2.3.2 Calibration

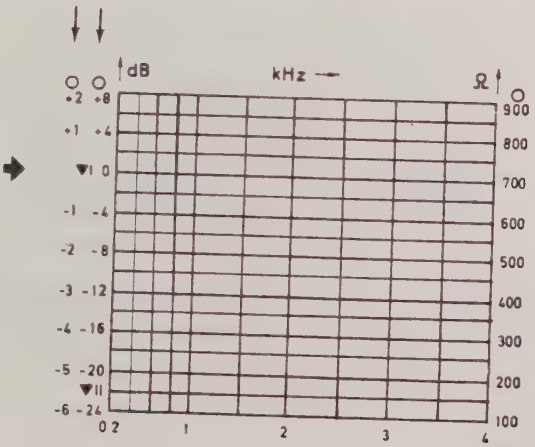
Set the mode of operation switch S3 to calibration ▼I; this switches all the necessary functions to calibration.



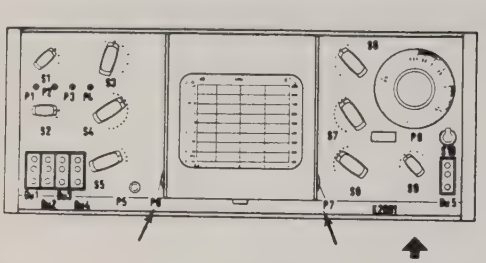
The trace should be on the 0 dB line; it can be adjusted with potentiometer ▼I, P4. Ensure that the calibration is carried out in the same display range in which measurements are subsequently to be made, i.e.

for normal display: switch S2 to "32 dB"

for expanded display: switch S2 to "8 dB".



First switch on the sweep generator with switch S9 (generator section) and select the required sweep rate. To obtain a display, set switch S3 to calibration ▼I.



Set an optimum display with potentiometers P6 (intensity) and P7 (focus).

The scale illumination (for photographing) is set with potentiometer 5. In the case of battery operation the illumination is only switched on when regulating button P5 is depressed however.

2.3.1 Horizontal deflection, frequency marker

The mode of deflection is selected with switch S1.

Position 1, "REC W f-MARK" means: The deflection voltage is obtained via the discriminator of the receiver section; in addition the frequency marker is switched on.

Position 2, "REC" as position 1, but without frequency marker.

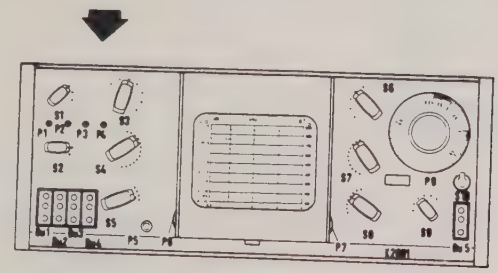
Position 3, "TRANSM" means: The deflection voltage is taken directly from the generator section.

For measurements over the line (physical separation of the transmitting and receiving stations) switch S1 must be set to position 1 or 2; for loop measurements position 3 can also be used.

The frequency marker is set with potentiometer P8 (switch S1 in position 1) and the frequency is read off its circular scale.
The "Frequency marker" module K5104 is included in modification set K3010. Optional. Before the "Frequency marker" module is inserted remove the 31 contact connector strip 5166. To facilitate correct insertion, a module layout plan is attached to the inside of the cover plate.

2.3 Receiver section

The receiver section controls are located on the left-hand side.



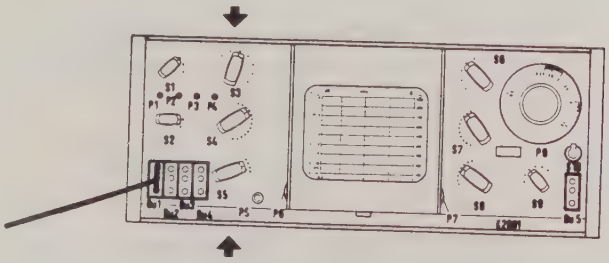
2.3.0 General

The input to the level meter is at jack Bu1;
the receiver cable with the three-pin plug should be connected there when level measurements are carried out.

The input impedance 600 Ω, 900 Ω or > 25 kΩ is determined by the position of switch S5.

The operating mode: calibration, level measurement, measurement of impedance or return loss, is selected with switch S3.

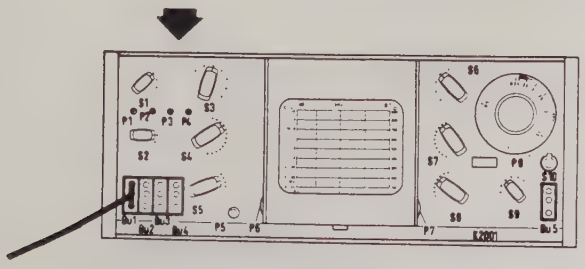
The sensitivity of the level meter is set with switch S4 and, if necessary, the display range is set with switch S2.



The settings of these switches for the individual measurements is specified in each case in section 2.4 "Measurements".

The following settings and connections are independent of the operating mode:

Level measurement in the repeater station



Connect the test line to jack Bu1

S1: REC W f-MARK (horizontal deflection from the receiver, with frequency marker)

S5: > 25 kΩ (600Ω) (line is terminated)

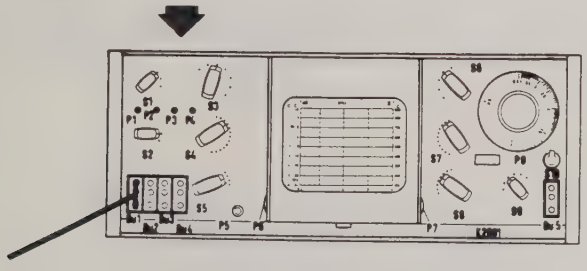
S3: LEVELING (level measurement)

S4: Set sensitivity so that the response is about on the 0 dB line

S2: normal display or expanded display

P8: frequency marker

Level measurement in station B



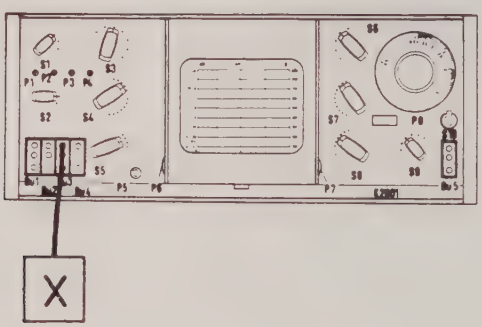
Set switch S5 to correct impedance (600Ω)

other settings as in the repeater station

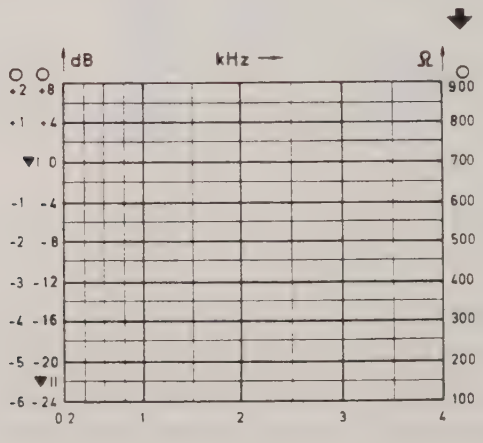
The net loss is the difference between the generator and received levels when the test item is terminated at the input and output with 600Ω . Carry out measurement as for level measurement, with S8 on the generator section and

S5 on the receiver section set to 600 Ω . For an output level of 0 dBm the net loss has the same magnitude as the indicated level, but has the opposite sign.

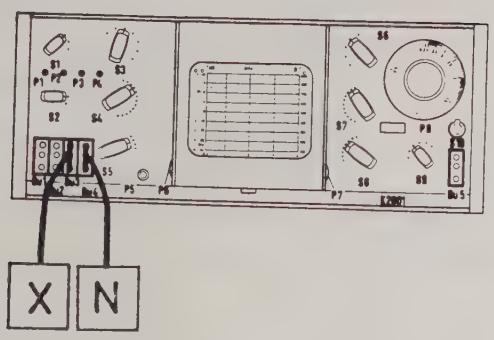
2.4.4 Impedance measurement



Connect the two-terminal network to jack "X", Bu3,
Set switch S3 to "IMP MEAS" (impedance)
(this marks the impedance scale)
The position of level switch S4 is unimportant.
Set an optimum response curve using switch S8 (in the generator section) and multiply the scale impedance values by the indicated factor (S8).



2.4.5 Impedance comparison measurement



Connect the test item and the standard to jacks "X", Bu3 and "N", Bu4.

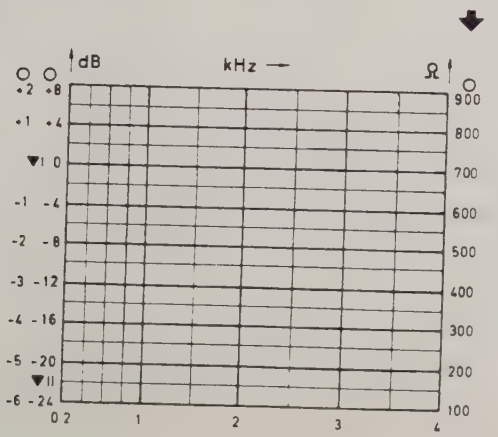
Set switch S3 to "IMP COMP X/N" (impedance comparison)
The position of level switch S4 is unimportant.

Both impedance curves are traced,

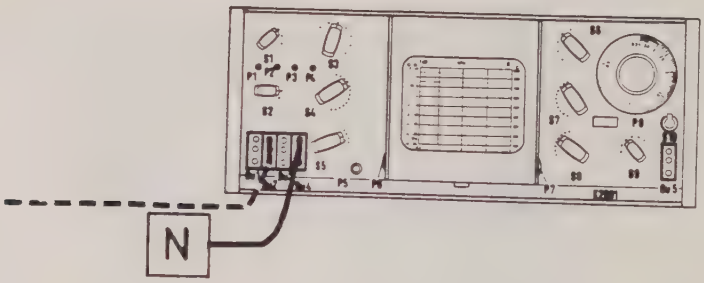
Curve "X" during the forward sweep (increasing frequency)
and

Curve "N" during the return sweep.

Range switch S8: take into account the factor for the impedance scale.



2.4.6 Return loss measurement, balancing of lines



Connect the balancing network to jack "N", Bu4 (connect the line to jack "X", Bu3 or jack "line", Bu2, if the ringing signal blocking capacitor is to be included in the balancing network.

Set mode of operation switch S3 to position: "RETURN LOSS".

Set the measuring sensitivity with level switch S4, so that the response curve is in the upper section of the screen.

The output level is set to a fixed value (+ 6 dB); the value of the return loss can be read directly from level switch S4 and the screen scale. The expanded display can also be switched in. (S2).

The line balancing network can be optimally set by means of the response curve, so that the return loss reaches a maximum over the whole of the frequency range, i.e. the display is at a minimum.

3. Maintenance instructions

Note ! High voltages are present in the unit.
Before opening the unit pull out the power plug !
If the unit is operated with the case open, comply with the instructions in section 4.1. !

The circuit of the level tracer incorporates silicon transistors and requires no maintenance.
The rotary switches on the front panel also require no maintenance. On no account must they be treated with a lubricant or a grease solvent.

The screen graticule should be dusted ocassionally. Mostly it is sufficient to lift up the frame and wipe the plexiglass plate in situ with an antistatic cloth.
The plexiglass plate and the filter foil located behind it can, however, be removed and cleaned with an antistatic cloth. Handle the filter foil carefully !

Then push the filter and the screen graticule back onto the pins and close the frame.

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4. TROUBLESHOOTING, FAULT CLEARING

4.1 General

The relevant safety regulations (e.g. in Germany the VDE regulations) must be complied with when an opened test instrument is connected to the ac power line.

The cathode-ray tube employs voltages of up to 2.2 kV. Since these voltages are lethal, contact with parts carrying voltage must be avoided. The supply voltage must be disconnected before any operation is carried out on the unit (e.g. changing a component or transistor).

Do not work alone in the room !
Use only one hand when making measurements on the CRT section !

If the type of fault observed is listed in the trouble-shooting table, proceeding in accordance with the details given there will considerably shorten troubleshooting.

The documents for troubleshooting are troubleshooting charts nos. 1 to 8 and the troubleshooting table; in addition the corresponding wiring diagrams and circuit diagrams for the unit and modules. The troubleshooting table indicates the troubleshooting charts to be used and fault clearing sections. The supply voltages (in the case of transistors collector-base-emitter voltages as well as dc voltages for relays and zener diodes) should be measured with the aid of the circuit diagrams and compared with the values given in the circuit diagram.

Unless otherwise specified ac voltages must be measured with a high-impedance broadband voltmeter (frequency range 200 Hz - 6 kHz), dc voltages with a multimeter.

For certain settings a digital voltmeter is required. When a component detected as the cause of the fault is replaced by a new one, readjustment of the frequency response, the oscillator frequency or the gain may be necessary. If several transistors or diodes are removed during troubleshooting, it must be ensured that they are reinserted in the same place in the module after testing - provided that they are not defective.

If a fault in a module cannot be unambiguously localized using the fault clearing instructions or if the necessary aids for fault clearing are not available, the module detected as defective can be changed without loss of time (request a spare module from the factory).

4.2 Troubleshooting with the level tracer switched off

If a fault became noticeable on switching on the unit, first check whether an operating error has been made. If the unit is completely dead, check the mode of operation setting (line voltage, internal battery, external battery), in addition the power cable and fuse. Furthermore carry out a visual inspection of the unit. For this purpose remove the cover plates and check the plug-in modules for correct insertion.

4.3 Troubleshooting with the level tracer switched on

4.3.1 Test equipment required

4.3.1.1 Troubleshooting

DC multimeter Ri $\geq$ 50 kΩ/V
e.g. Siemens μA Multizet
Broadband level meter 200 Hz - 6 kHz, Ri $\geq$ 20 kΩ
Oscilloscope
DC voltage source (adjustable from 0 to 4 V)
Dropping resistor 100 MΩ

4.3.1.2 Fault clearing

1 digital voltmeter
1 digital level meter (e.g. D 2010)
1 oscilloscope
1 frequency counter
1 distortion bridge
dc power supplies
1 μA multimeter
1 mA multimeter

4.4 Troubleshooting table

Troubleshooting is especially simple with level tracer K 2001, since the unit forms a complete test setup, so that on failure of the receiver section, for example, this can be checked with the aid of the built-in generator.

The following lists faults on the unit and the corresponding procedure for troubleshooting by means of the troubleshooting plans.

4.4.1 Visual indicator for the supply voltages not present

Ensure that the mode of operation switch (S12 at the rear of the unit) is set correctly.

Further procedure in accordance with troubleshooting chart no. 1.

4.4.2 Luminous spot cannot be set

Visual signal present ? — No → Troubleshooting chart no.1

Yes ↓

Switch S3 in position " ▼ I"
Switch S9 in position "Sweep"
Is the level indicated correctly ?

Yes → Generator, receiver section and CRT section are in working order, the fault is in the control panel. Troubleshooting charts 5,6

No ↓

Switch S3 in position "Leveling"
S6 and S7 in position "0 dB"
Using the broadband voltmeter
check the voltage at the
output sockets.

Is the level 0 dB — No → Troubleshooting chart no.6

Yes ↓

Troubleshooting chart no. 4

4.4.3 Calibration cannot be carried out

Switch S3 to position " ▼ I"
Check the output level in accordance with trouble-
shooting chart no. 6

Output level correct ? — No → Troubleshooting chart no.3

Yes ↓

Troubleshooting chart no. 4
Check the wiring to potentiometers P3 and P4.

4.4.4 Sweeping cannot be carried out

Troubleshooting chart no. 7

4.4.5 Frequency suppression not functioning

Troubleshooting chart no. 3
Fault clearing: section 4.6.8

4.4.6 N-X changeover not functioning

Fault clearing: section 4.6.9.8

4.4.7 Horizontal deflection not functioning

Troubleshooting charts nos. 4, 5
Fault clearing: section 4.6.12

Check the wiring to potentiometers 1 and 2.

4.4.8 Vertical deflection not functioning

Troubleshooting charts nos. 4,5
Fault clearing: section 4.6.13

Check the wiring to potentiometers 3 and 4.

4.5 Troubleshooting charts

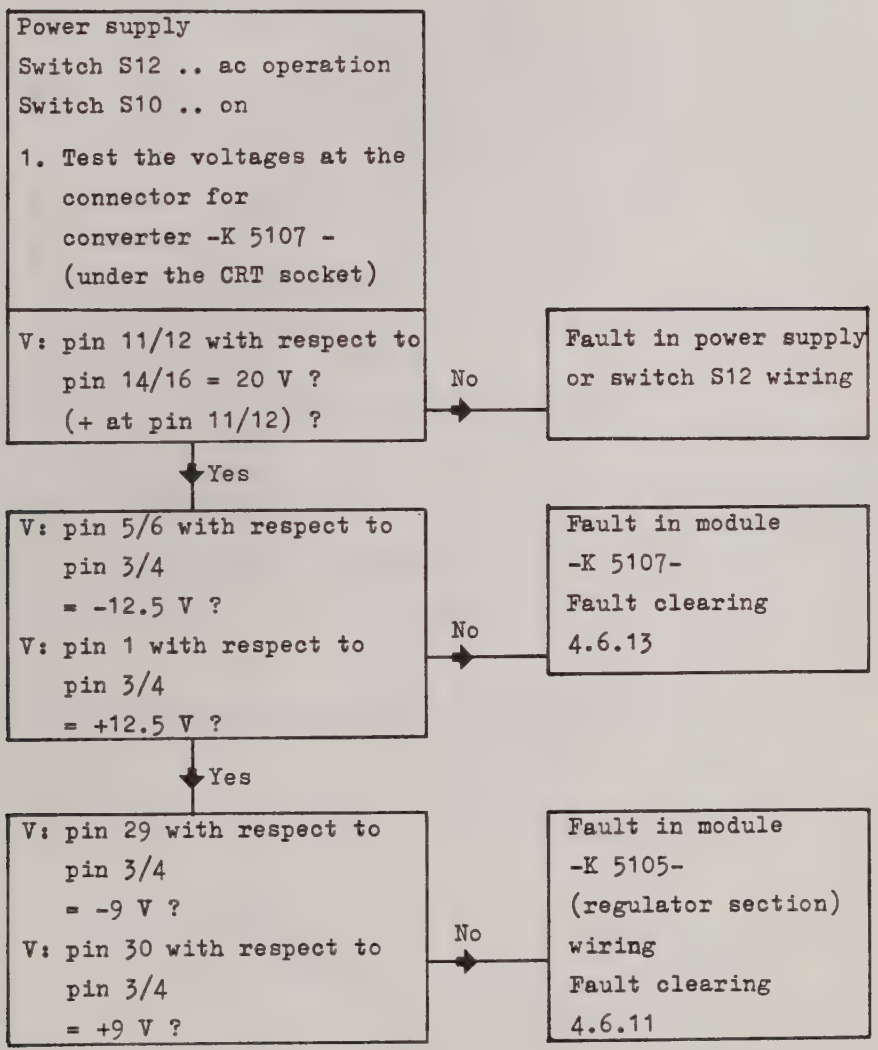
4.5.1 Troubleshooting chart no. 1

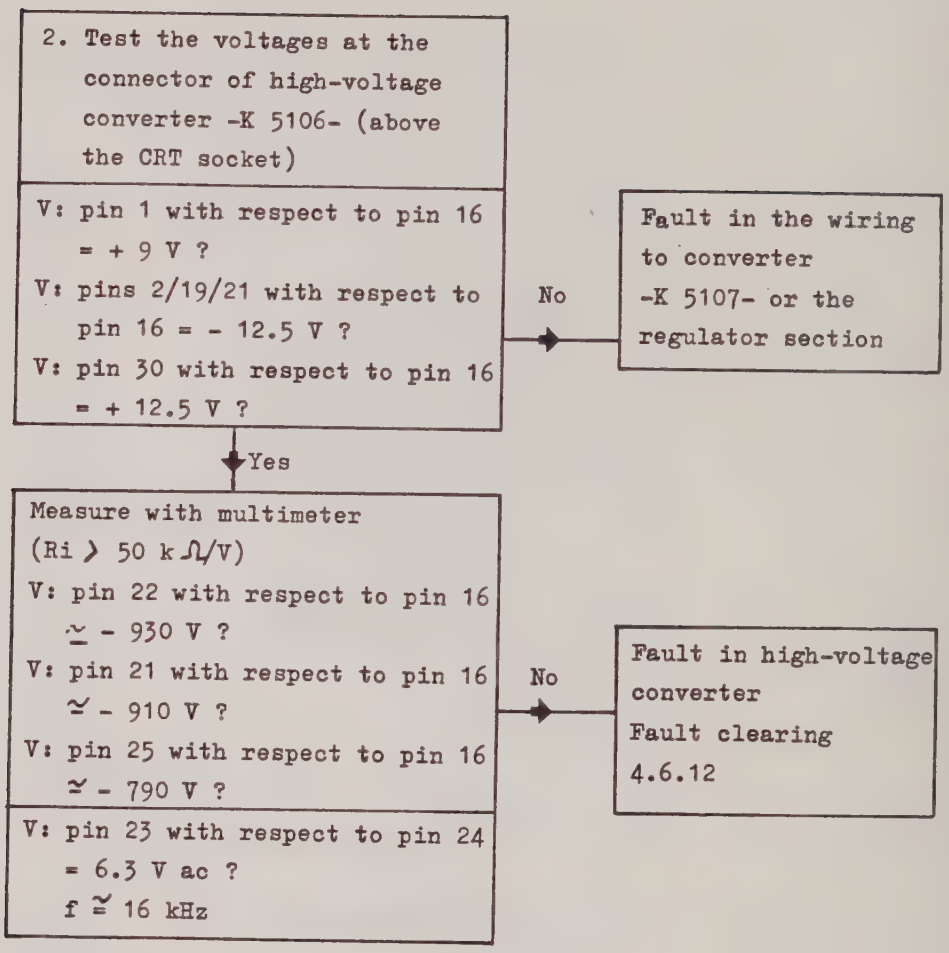
Supply voltages

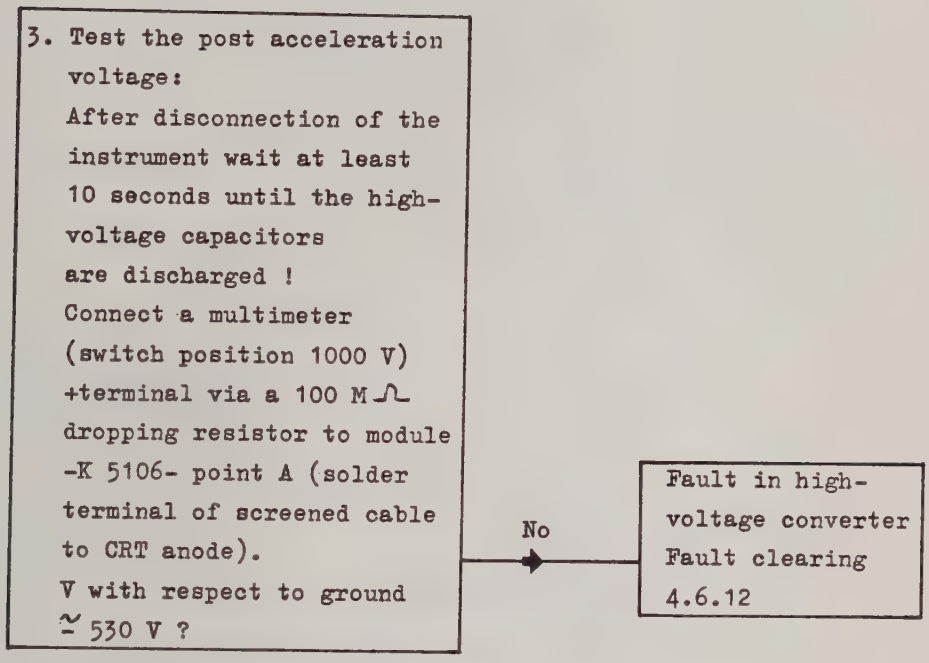
4.5.1.1 General

After removal of the upper and rear cover plates the power supply -K5111 - as well as converter - K5107 - (under the CRT socket) and high-voltage converter -K5106 - (above the CRT socket) are visible. The high-voltage converter is covered with an insulating plate, as are the connectors for modules -K 5107 - and -K 5106 -. After removing these plates voltages of up to 2.2 kV are accessible; the appropriate regulations for working with high voltages must be complied with.

4.5.1.2 Troubleshooting


Power supply
Switch S12 .. ac operation
Switch S10 .. on
1. Test the voltages at the connector for converter -K 5107 - (under the CRT socket)
V: pin 11/12 with respect to pin 14/16 = 20 V ? (+ at pin 11/12) ?
No
Fault in power supply or switch S12 wiring
Yes
V: pin 5/6 with respect to pin 3/4 = -12.5 V ?
V: pin 1 with respect to pin 3/4 = +12.5 V ?
No
Fault in module -K 5107- Fault clearing 4.6.13
Yes
V: pin 29 with respect to pin 3/4 = -9 V ?
V: pin 30 with respect to pin 3/4 = +9 V ?
No
Fault in module -K 5105- (regulator section) wiring Fault clearing 4.6.11


2. Test the voltages at the connector of high-voltage converter -K 5106- (above the CRT socket)
V: pin 1 with respect to pin 16 = + 9 V ?
V: pins 2/19/21 with respect to pin 16 = - 12.5 V ?
V: pin 30 with respect to pin 16 = + 12.5 V ?
No
Fault in the wiring to converter -K 5107- or the regulator section
Yes
Measure with multimeter (Ri ⟩ 50 kΩ/V)
V: pin 22 with respect to pin 16 ≃ - 930 V ?
V: pin 21 with respect to pin 16 ≃ - 910 V ?
V: pin 25 with respect to pin 16 ≃ - 790 V ?
No
Fault in high-voltage converter
Fault clearing 4.6.12
V: pin 23 with respect to pin 24 = 6.3 V ac ?
f ≃ 16 kHz


3. Test the post acceleration voltage:
After disconnection of the instrument wait at least 10 seconds until the high-voltage capacitors are discharged !
Connect a multimeter (switch position 1000 V) +terminal via a 100 MΩ dropping resistor to module -K 5106- point A (solder terminal of screened cable to CRT anode).
V with respect to ground ≃ 530 V ?
No
Fault in high-voltage converter
Fault clearing
4.6.12

4.5.2 Troubleshooting chart no. 2 - CRT section

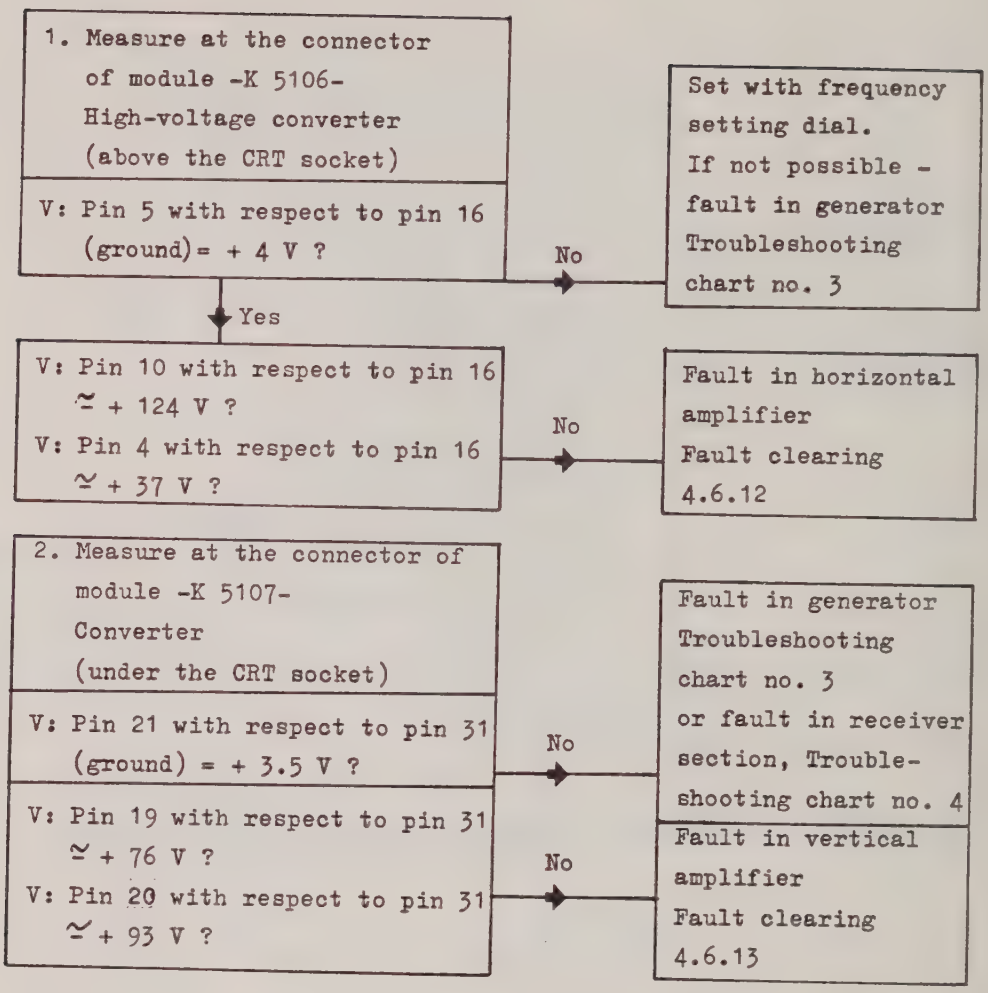
4.5.2.1 General

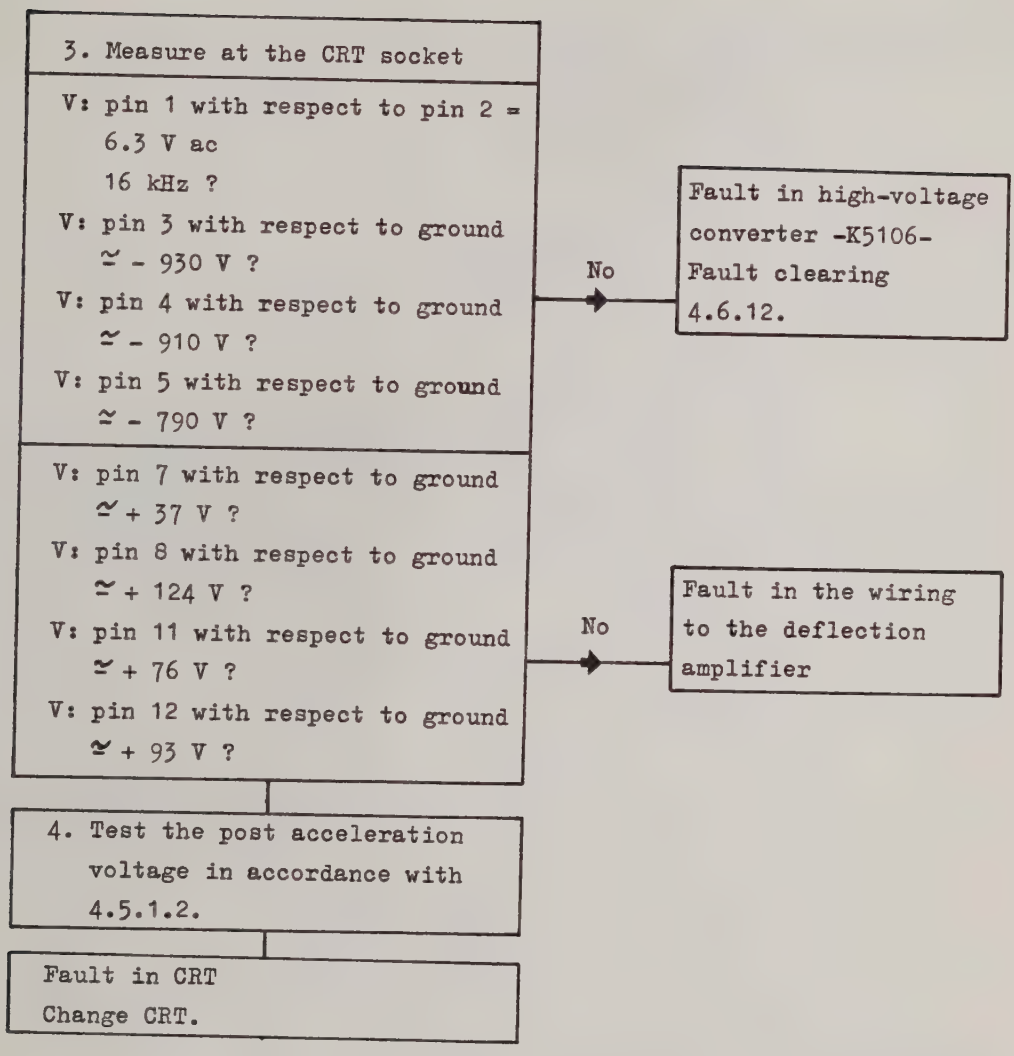
See 4.5.1.1.

4.5.2.2 Troubleshooting

Power supply: Switch S3 ... ▼ I
S9 ... Manual control
S1 ... Generator

Frequency setting 4 kHz


1. Measure at the connector of module -K 5106- High-voltage converter (above the CRT socket)
V: Pin 5 with respect to pin 16 (ground) = + 4 V ?
No
Set with frequency setting dial. If not possible - fault in generator Troubleshooting chart no. 3
Yes
V: Pin 10 with respect to pin 16 ≃ + 124 V ?
V: Pin 4 with respect to pin 16 ≃ + 37 V ?
No
Fault in horizontal amplifier Fault clearing 4.6.12
2. Measure at the connector of module -K 5107- Converter (under the CRT socket)
V: Pin 21 with respect to pin 31 (ground) = + 3.5 V ?
No
Fault in generator Troubleshooting chart no. 3 or fault in receiver section, Trouble-shooting chart no. 4
V: Pin 19 with respect to pin 31 ≃ + 76 V ?
V: Pin 20 with respect to pin 31 ≃ + 93 V ?
No
Fault in vertical amplifier Fault clearing 4.6.13


3. Measure at the CRT socket
V: pin 1 with respect to pin 2 = 6.3 V ac 16 kHz ?
V: pin 3 with respect to ground ≃ - 930 V ?
V: pin 4 with respect to ground ≃ - 910 V ?
V: pin 5 with respect to ground ≃ - 790 V ?
No
Fault in high-voltage converter -K5106- Fault clearing 4.6.12.
V: pin 7 with respect to ground ≃ + 37 V ?
V: pin 8 with respect to ground ≃ + 124 V ?
V: pin 11 with respect to ground ≃ + 76 V ?
V: pin 12 with respect to ground ≃ + 93 V ?
No
Fault in the wiring to the deflection amplifier
4. Test the post acceleration voltage in accordance with 4.5.1.2.
Fault in CRT
Change CRT.

4.5.3 Troubleshooting chart no. 3 - generator

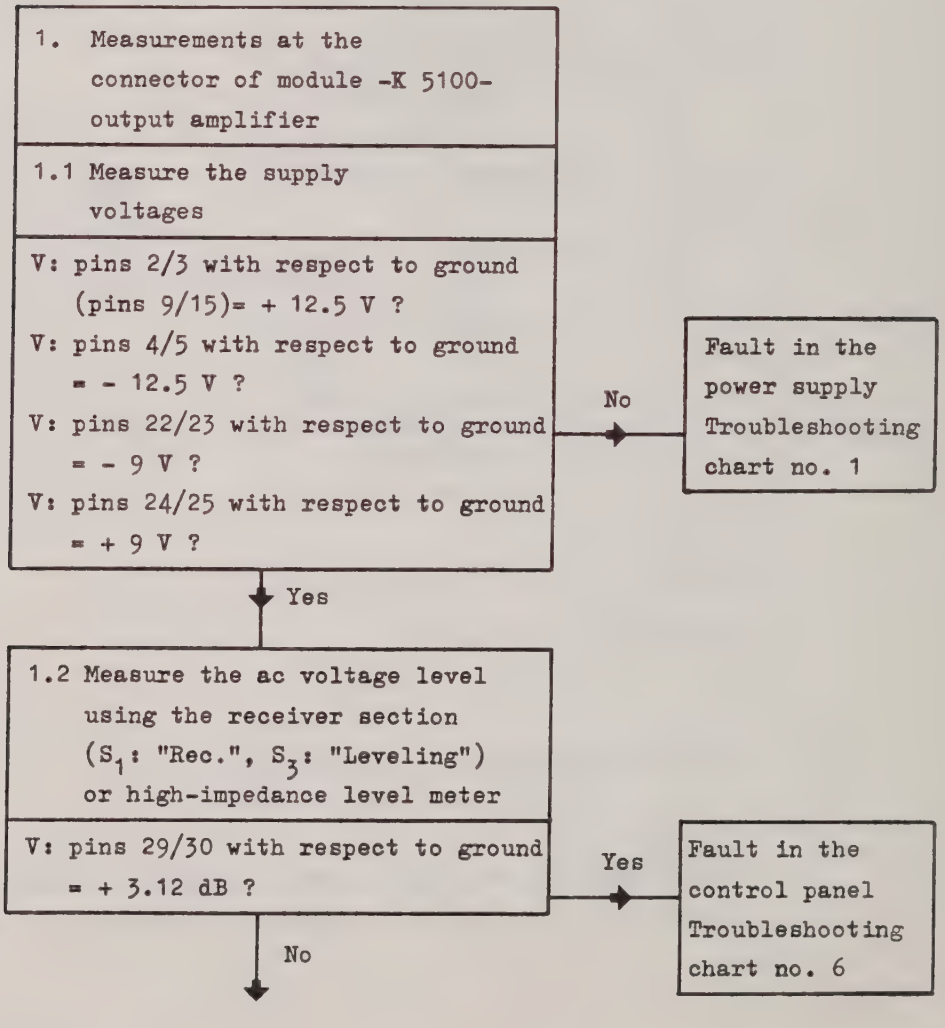
4.5.3.1 General

After removing the bottom plate the wiring is accessible from underneath. The connectors of the modules are marked.

4.5.3.2 Troubleshooting

Switch positions:
S6 ... "0 dB", S7 ... "0 dB"
S3 ... "Leveling"
S8 ... "0/600 "
S9 ... "Manual control"
S11... "Without frequency suppression"

Frequency setting 4 kHz


1. Measurements at the connector of module -K 5100- output amplifier
1.1 Measure the supply voltages
V: pins 2/3 with respect to ground (pins 9/15)= + 12.5 V ?
V: pins 4/5 with respect to ground = - 12.5 V ?
V: pins 22/23 with respect to ground = - 9 V ?
V: pins 24/25 with respect to ground = + 9 V ?
No
Fault in the power supply Troubleshooting chart no. 1
Yes
1.2 Measure the ac voltage level using the receiver section (S_1: "Rec.", S_3: "Leveling") or high-impedance level meter
V: pins 29/30 with respect to ground = + 3.12 dB ?
Yes
Fault in the control panel Troubleshooting chart no. 6
No

V: pins 17/18 with respect to ground
= + 0.65 dB ?

Yes → Fault in module -K 5100- Fault clearing 4.6.6

No

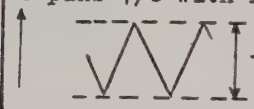
V: pins 13/14 with respect to ground
= + 10.65 dB ?

Yes → Fault in level switch S4, S1 or wiring

No

1.3 Measure the triangular voltage waveform with the oscilloscope

V: pins 7/8 with respect to ground:



Yes → Fault in module -K 5100- Fault clearing 4.6.6

No

2. Measurements at the connector of module -K 5101- V/f converter

2.1 Measure the supply voltages

V: pins 2/3 with respect to ground (pins 15/16) = + 12.5 V ?
V: pins 4/5 with respect to ground = - 12.5 V ?
V: pins 22/23 with respect to ground = - 9 V ?
V: pins 24/25 with respect to ground = + 9 V ?

No → Fault in the power supply, basic wiring, plug

2.2 Measure the triangular voltage waveform with the oscilloscope

V: pins 7/8 with respect to ground:

Yes → Fault in the wiring to module -K 5100-

2.3 Measure the dc voltage at the input of the module

V: pins 28/29 = 4 V ?

Yes → Fault in module -K 5101- Fault clearing 4.6.7.

No

3. Measurements at the connector of module -K5102- Frequency suppression

3.1 Measure the supply voltages in accordance with 2.1

3.2 Measure the dc voltage at the input of the module

V: pins 28/29 with respect to ground = 4 V ?

Yes → Fault in module -K 5102- Fault clearing 4.6.8. Wiring

No

Fault in module -K 5110- Potentiometer for frequency setting

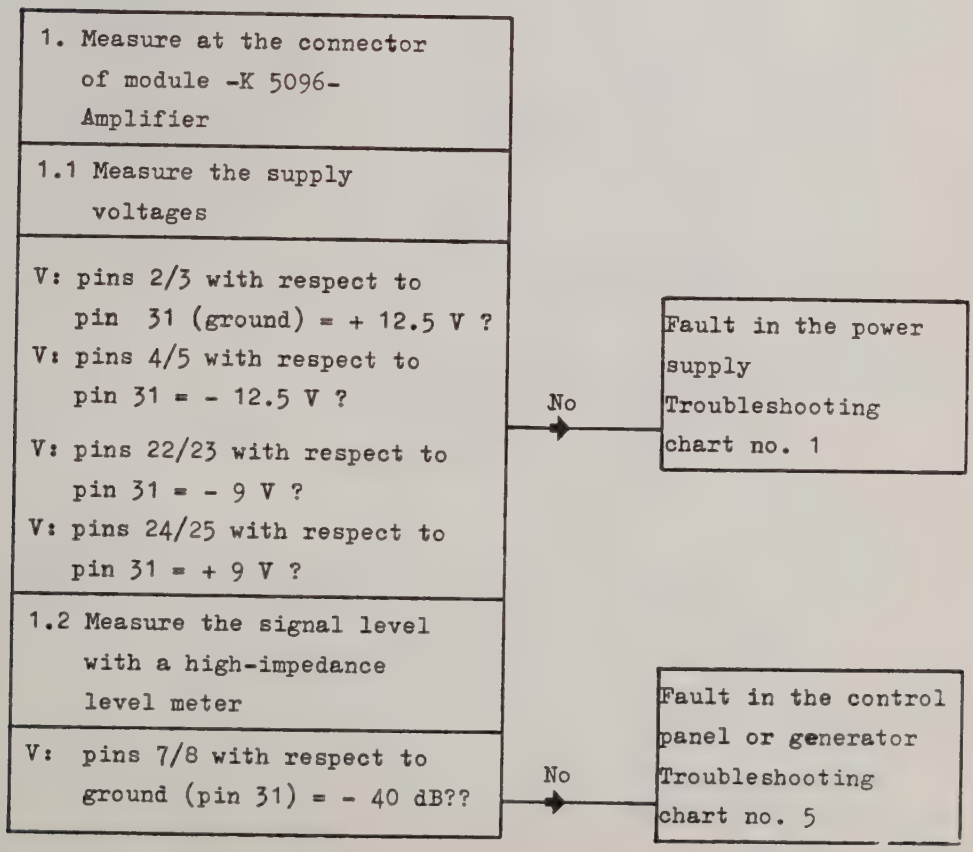
4 5.4 Troubleshooting chart no. 4 - receiver

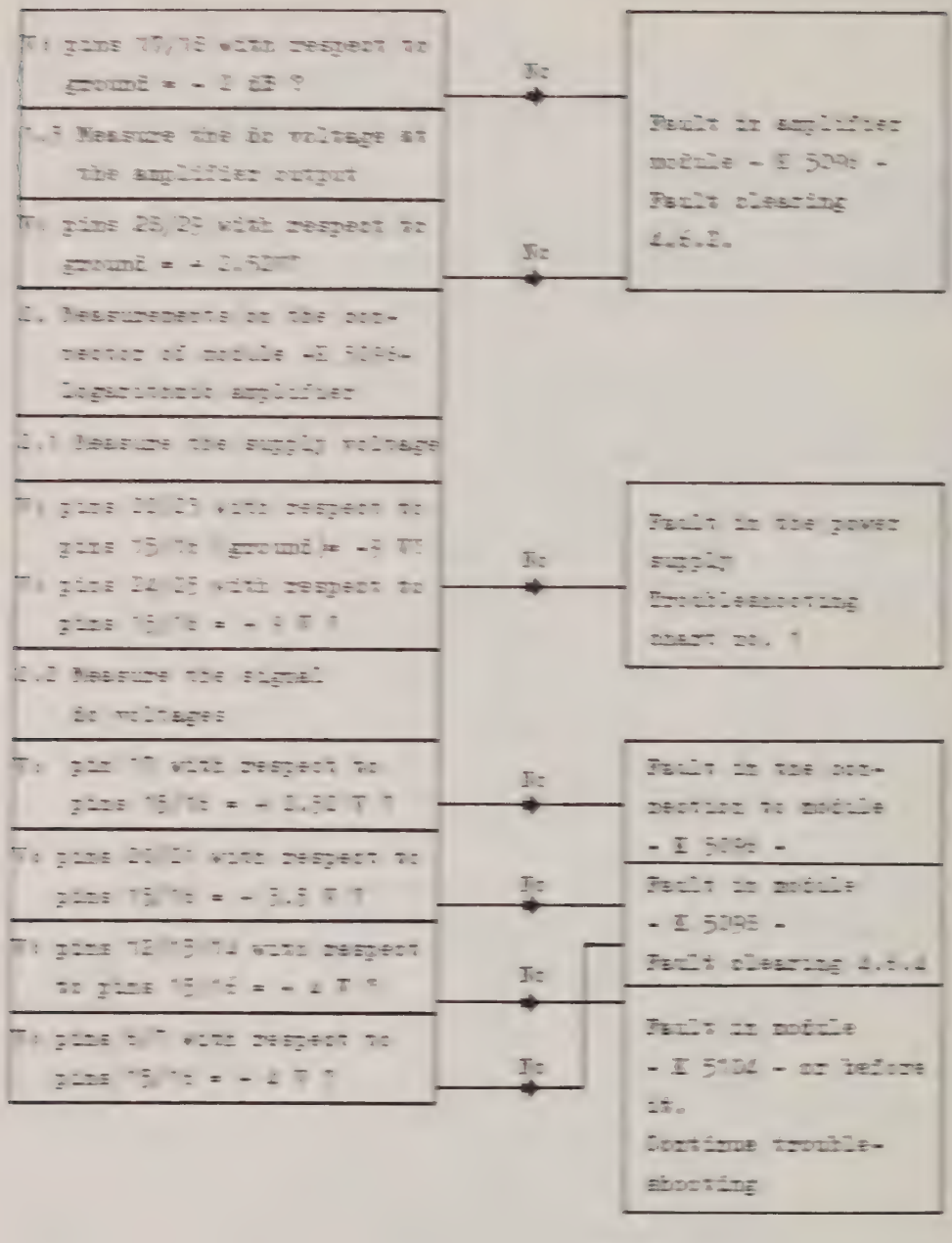
4,5.4.1 General

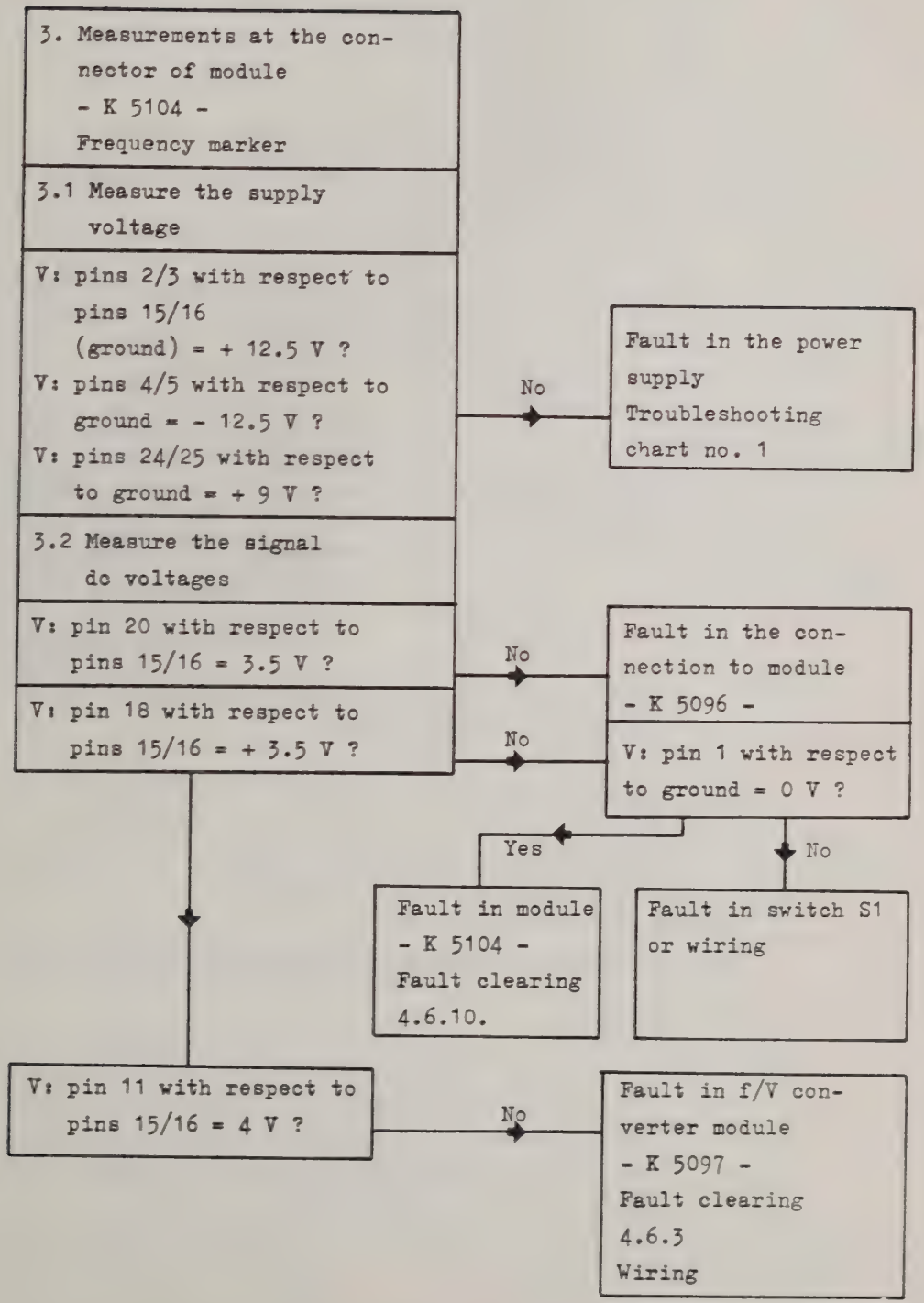
After removing the bottom plate the wiring is accessible from underneath. The connectors of the modules must be tested in accordance with the marking.

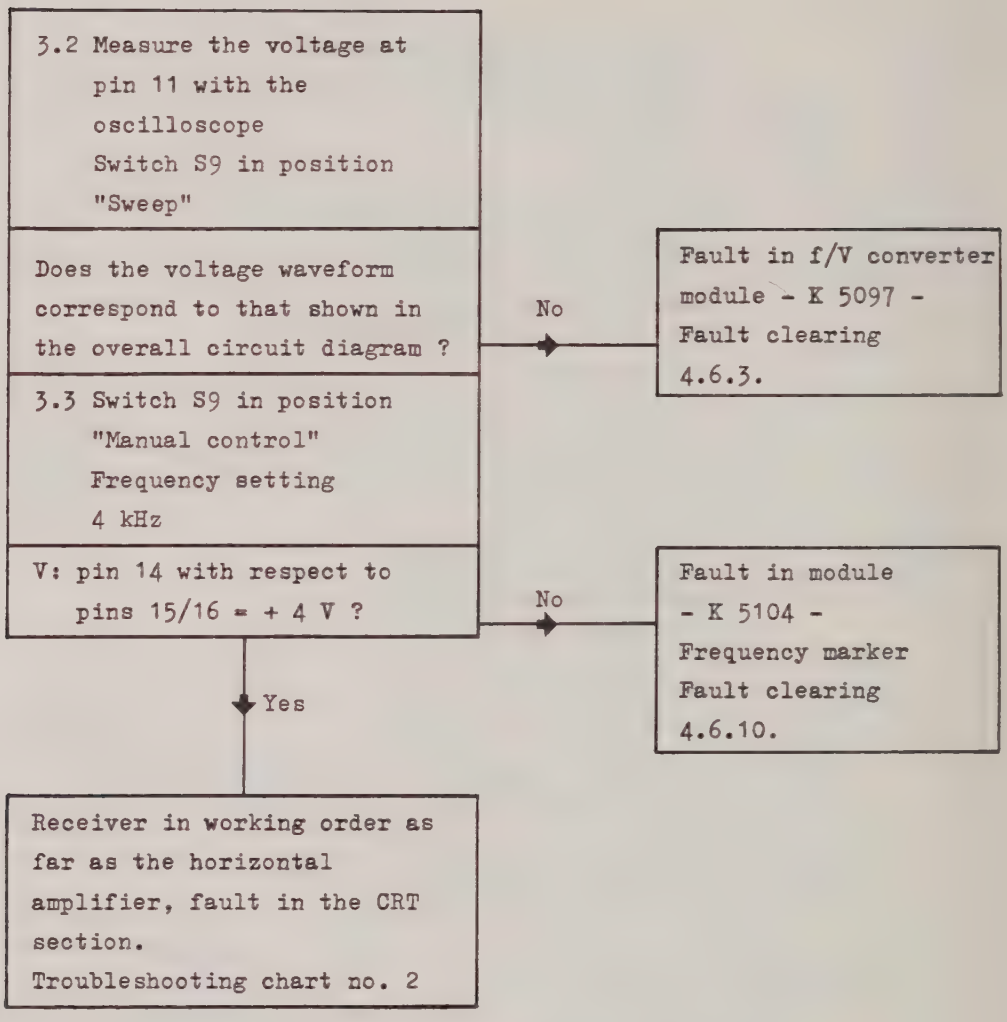
4.5.4.2 Troubleshooting

Switch positions:
S1 ... Receiver
S3 ... ▼ I
S9 ... Manual control
Frequency setting 4 kHz


1. Measure at the connector of module -K 5096- Amplifier
1.1 Measure the supply voltages
V: pins 2/3 with respect to pin 31 (ground) = + 12.5 V ?
V: pins 4/5 with respect to pin 31 = - 12.5 V ?
V: pins 22/23 with respect to pin 31 = - 9 V ?
V: pins 24/25 with respect to pin 31 = + 9 V ?
No
Fault in the power supply Troubleshooting chart no. 1
1.2 Measure the signal level with a high-impedance level meter
V: pins 7/8 with respect to ground (pin 31) = - 40 dB??
No
Fault in the control panel or generator Troubleshooting chart no. 5


No
Fault in amplifier module - E 5095 - Fault clearing 4.6.2.
No
No
Fault in the power supply Troubleshooting chart no. 1
No
Fault in the oscillator module - E 5094 -
No
Fault in module - E 5095 - Fault clearing 4.6.4
No
Fault in module - E 5104 - or before it. Continue trouble-shooting
No


3. Measurements at the connector of module - K 5104 - Frequency marker
3.1 Measure the supply voltage
V: pins 2/3 with respect to pins 15/16 (ground) = + 12.5 V ?
V: pins 4/5 with respect to ground = - 12.5 V ?
V: pins 24/25 with respect to ground = + 9 V ?
No
Fault in the power supply Troubleshooting chart no. 1
3.2 Measure the signal dc voltages
V: pin 20 with respect to pins 15/16 = 3.5 V ?
No
Fault in the connection to module - K 5096 -
V: pin 18 with respect to pins 15/16 = + 3.5 V ?
No
V: pin 1 with respect to ground = 0 V ?
Yes
No
Fault in module - K 5104 - Fault clearing 4.6.10.
Fault in switch S1 or wiring
V: pin 11 with respect to pins 15/16 = 4 V ?
No
Fault in f/V converter module - K 5097 - Fault clearing 4.6.3 Wiring


3.2 Measure the voltage at pin 11 with the oscilloscope Switch S9 in position "Sweep"
Does the voltage waveform correspond to that shown in the overall circuit diagram ?
No
Fault in f/V converter module - K 5097 - Fault clearing 4.6.3.
3.3 Switch S9 in position "Manual control" Frequency setting 4 kHz
V: pin 14 with respect to pins 15/16 = + 4 V ?
No
Fault in module - K 5104 - Frequency marker Fault clearing 4.6.10.
Yes
Receiver in working order as far as the horizontal amplifier, fault in the CRT section.
Troubleshooting chart no. 2

4.5.5 Troubleshooting chart no. 5 - control panel, receiver section

4.5.5.1 General

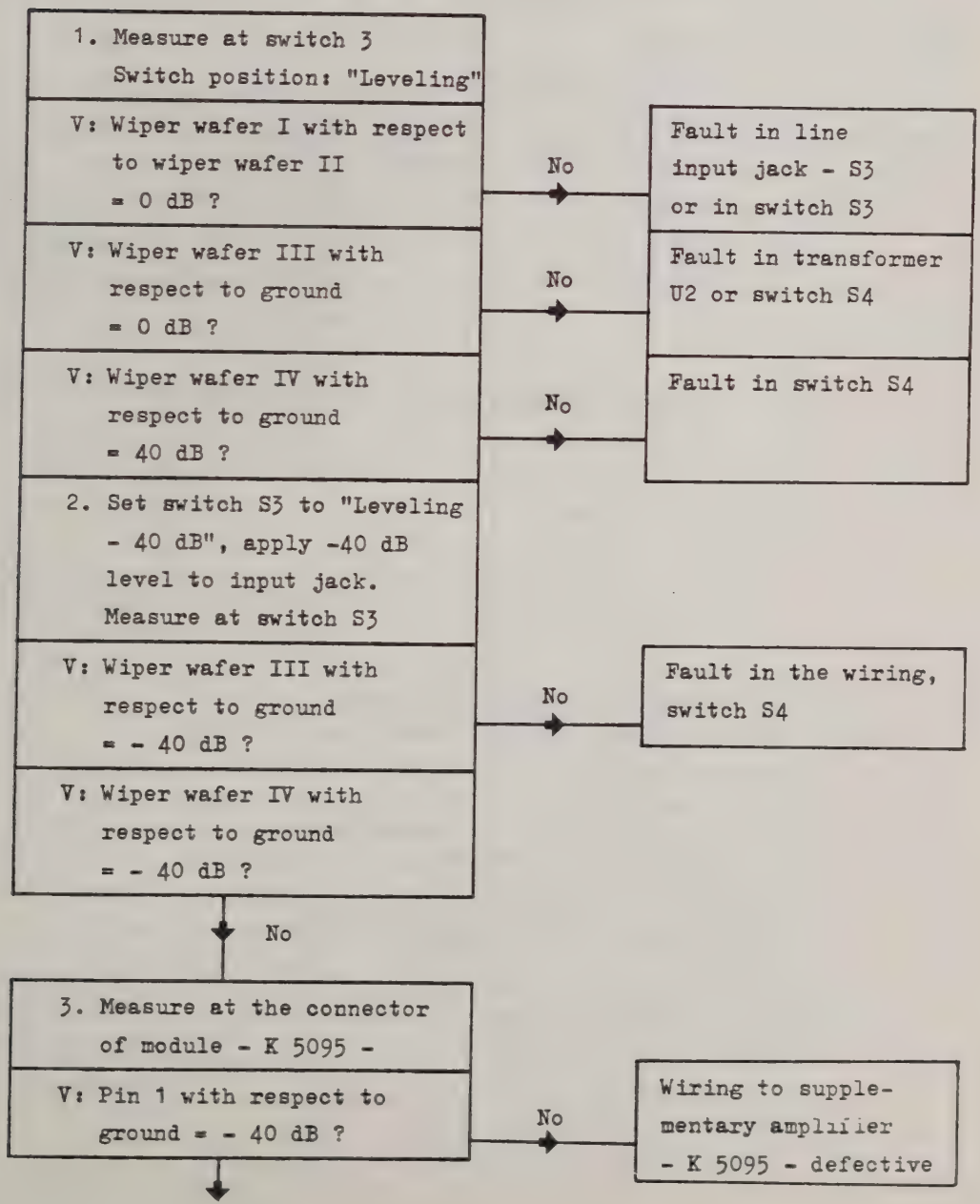
Switches S1 to S5 are accessible after removing the top, left and bottom cover plates. If the fault cannot be localized by a visual check, it is advisable to proceed in accordance with the following troubleshooting chart. The switch wafers are numbered from the front panel (I, II, ...).

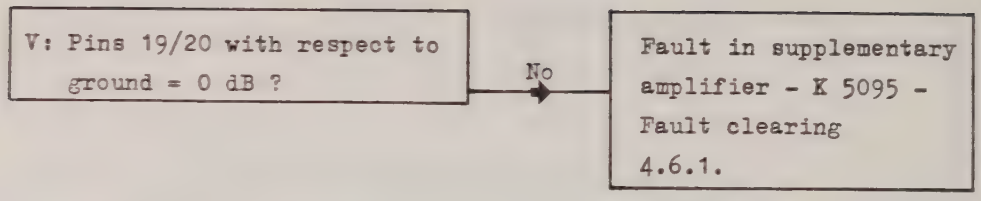
4.5.5.2 Troubleshooting

Switch positions:

S4 ... "0 dB"

A signal in the frequency range 200 Hz - 4 kHz with a level of 0 dB must be applied to the input jack.


1. Measure at switch 3
Switch position: "Leveling"
V: Wiper wafer I with respect to wiper wafer II = 0 dB ?
No
Fault in line input jack - S3 or in switch S3
V: Wiper wafer III with respect to ground = 0 dB ?
No
Fault in transformer U2 or switch S4
V: Wiper wafer IV with respect to ground = 40 dB ?
No
Fault in switch S4
2. Set switch S3 to "Leveling - 40 dB", apply -40 dB level to input jack. Measure at switch S3
V: Wiper wafer III with respect to ground = - 40 dB ?
No
Fault in the wiring, switch S4
V: Wiper wafer IV with respect to ground = - 40 dB ?
No
3. Measure at the connector of module - K 5095 -
V: Pin 1 with respect to ground = - 40 dB ?
No
Wiring to supplementary amplifier - K 5095 - defective



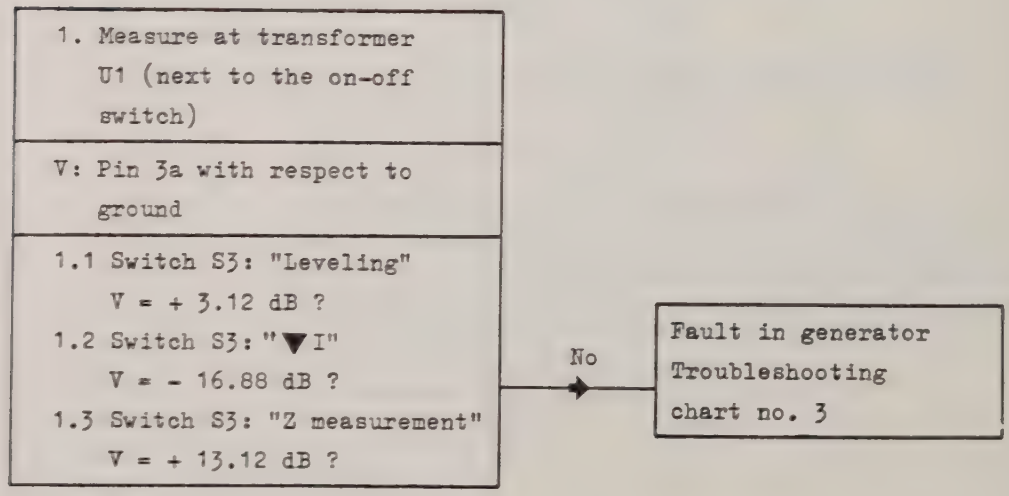
4.5.6 Troubleshooting chart no. 6 - control panel, generator section

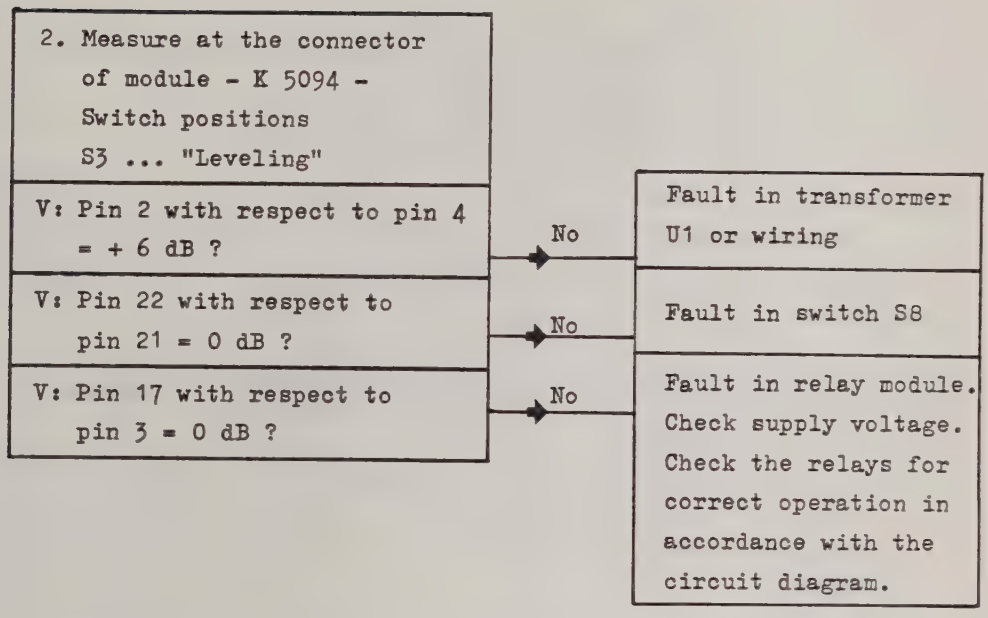
4.5.6.1 General

Switches S6 to S9 are accessible after removing the top and bottom cover plates and the right-hand side plate. If a fault cannot be determined by a visual inspection, it is advisable to proceed in accordance with the following chart. The receiver in the "leveling" mode (S3 in position "▼I" or "Z measurement") is used as the test instrument. Check the voltage with a high-impedance level meter.

4.5.6.2 Troubleshooting

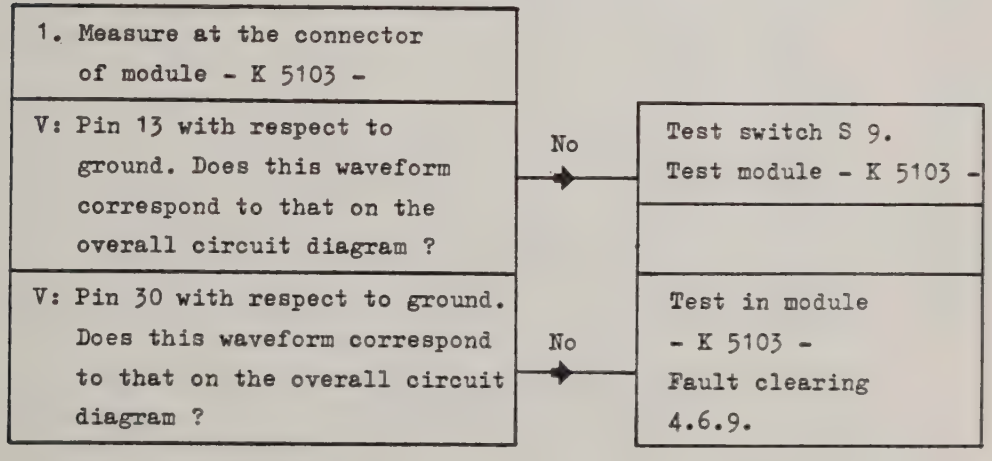
Switch positions:
S3 ... "Leveling"
S6 ... "0 dB"
S7 ... "0 dB"
S8 ... "600/0Ω"
S9 ..."Manual"

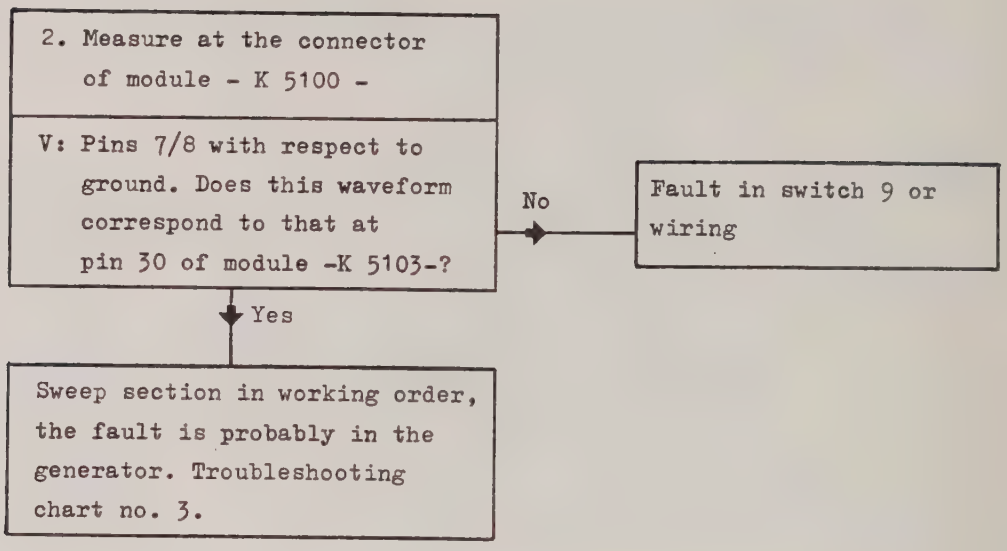

1. Measure at transformer U1 (next to the on-off switch)
V: Pin 3a with respect to ground
1.1 Switch S3: "Leveling"
V = + 3.12 dB ?
1.2 Switch S3: "▼I"
V = - 16.88 dB ?
1.3 Switch S3: "Z measurement"
V = + 13.12 dB ?
No
Fault in generator Troubleshooting chart no. 3


2. Measure at the connector of module - K 5094 - Switch positions S3 ... "Leveling"
V: Pin 2 with respect to pin 4 = + 6 dB ?
No
Fault in transformer U1 or wiring
V: Pin 22 with respect to pin 21 = 0 dB ?
No
Fault in switch S8
V: Pin 17 with respect to pin 3 = 0 dB ?
No
Fault in relay module. Check supply voltage. Check the relays for correct operation in accordance with the circuit diagram.

4.5.7 Troubleshooting chart no. 7 - sweeping

Switch positions:
S3 ... " ▼I"
S9 ... "Sweep"


1. Measure at the connector of module - K 5103 -
V: Pin 13 with respect to ground. Does this waveform correspond to that on the overall circuit diagram ?
No
Test switch S 9. Test module - K 5103 -
V: Pin 30 with respect to ground. Does this waveform correspond to that on the overall circuit diagram ?
No
Test in module - K 5103 - Fault clearing 4.6.9.


2. Measure at the connector of module - K 5100 -
V: Pins 7/8 with respect to ground. Does this waveform correspond to that at pin 30 of module -K 5103-?
No
Fault in switch 9 or wiring
Yes
Sweep section in working order, the fault is probably in the generator. Troubleshooting chart no. 3.

4.5.8 Troubleshooting chart no. 8 - relay table

The appropriate relay must be operated in the switch position marked ○ (+ 16 V at pin 3 of the relay).

Switch S 3							Relays	
I	II	Level-ing	Leveling -40 dB	Z measu rement	Z com-parison	Return loss		
						○	F2/3/4	Module -K 5094- Relay module
	○			○	○		Z/E	
		○	○				P1/2/3	
○	○						E2/3	
				○	○		Z 4	Loga-rithmic ampli-fier -K 5098-
			○				N	Supple-mentary amplifier -K 5095-
○	○						E 1	Output amplifier -K 5100-
						○	F 1	

The relays on module -K 5103- (sweep generator) are connected in accordance with the details given in 4.6.9.8.

4.6. Fault clearing

Hints on fault clearing

When a module has been found to be defective with the aid of a troubleshooting chart, it should first be subjected to a visual check. Overloaded resistors and coils can often be detected by their changed color (scorched). Before changing such components, the cause of the fault should always first be unambiguously determined and cleared: e.g. check the following transistor, diode or capacitor for short-circuit.

Fault clearing is simplified if the level tracer is used as the power supply for the modules and as the test generator or receiver. However, it must be ensured that the sections of the level tracer used are working correctly.

The individual plug-in modules are so dealt with in the following that testing and adjustment can be carried out independently of the rest of the unit.

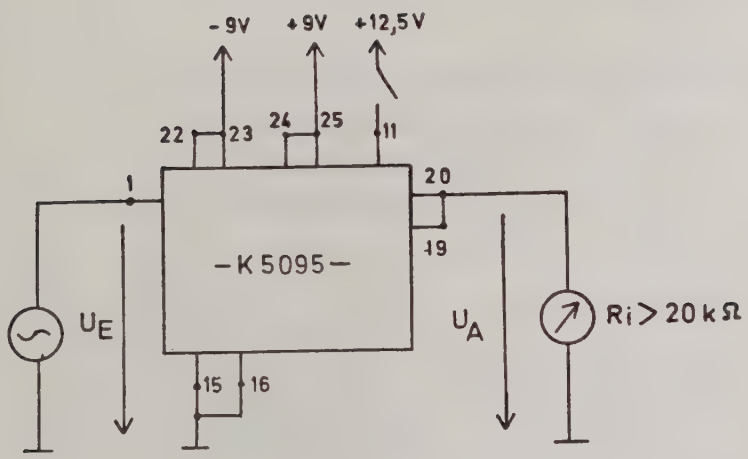
Before the level tracer is put into service after the changing or adjustment of modules, the settings must be checked in accordance with section 4.6.14.

4.6.1 Supplementary amplifier -K 5095-

4.6.1.1 Test equipment required

1 signal generator 200 Hz to 4 kHz
(e.g. generator section K/2001 W217)
1 level meter R_i > 20 kΩ
(e.g. D 342/D 2010)

1 multimeter



4.6.1.3 Current drain

+ 9 V ... I = 2.5 to 4 mA (pins 24/25)
- 9 V ... I = 2.5 to 4 mA (pins 22/23)

4.6.1.4 Setting the gain

A voltage V_{in}, 1 kHz, - 40 dB, is applied to pin 1.

Check the level at the places indicated in the circuit diagram.

Setting the gain with R17:
Apply + 12 V to pin 11.
At pin 1 apply V_{in}: 1 kHz, -40 dB.
At pin 19/20 set V_{out} with R17 to 0 dB.

4.6.1.5 Checking the frequency response

At pin 1 apply V_{in} - 40 dB, 200 Hz to 4 kHz.
At pins 19/20 V_{out} = 0 dB $\pm$ 0.5 %.

4.6.1.6 Checking the switching characteristic

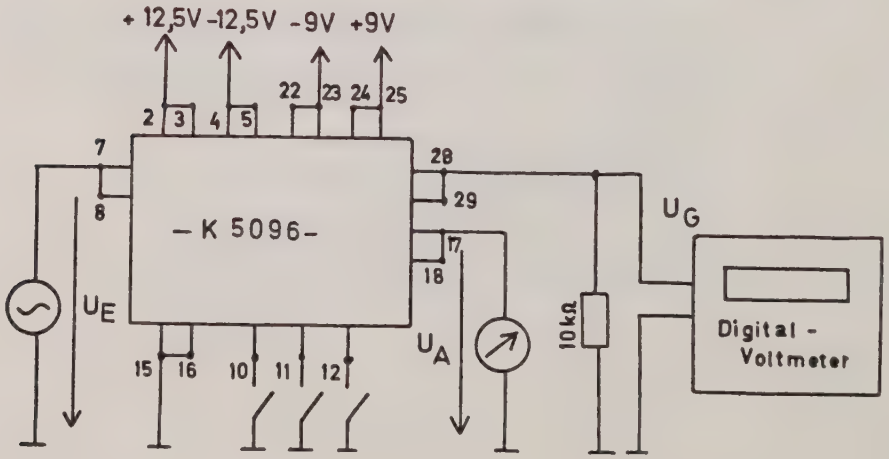
At pin I apply V_{in}: 1 kHz, - 40 dB.
Disconnect the + 12 V potential from pin 11.
At pins 19/20 V_{out} must be less than - 80 dB.

4.6.2. Amplifier - K 5096-

4.6.2.1 Test equipment required

1 signal generator 200 Hz to 4 kHz
(e.g. generator section K 2001 or 3 W 217)
1 level meter R_i > 20 kΩ
(e.g. D 342 or D 2010 or D 2014)
1 digital voltmeter
1 oscilloscope
1 multimeter
1 termination R_A = 10 kΩ

4.6.2.2 Connections



4.6.2.3 Current drain

+ 12.5 V ... I = 5.5 to 7.5 mA (pins 2/3)
- 12.5 V ... I + 5.5 to 7.5 mA (pins 4/5)

4.6.2.4 Setting the gain

Pins 10 and 11: disconnect
Pin 12: apply ground
Pin 7/8: apply V_{in}: 1 kHz, - 40 dB.

Check the level at the points indicated in the circuit diagram.
Setting the gain

1. Connect pin 12 to ground, disconnect pins 10 and 11.
   Apply V_{in}, 1 kHz, - 36 dB, to pins 7/8.
   Connect a digital voltmeter to pins 28/29 in accordance with 4.6.2.2 to measure the dc voltage V_{dc}. Using potentiometer R10, set V_{dc} to 4 V $\pm$ 10 mV.

2. Apply V_{in}, 1 kHz, - 64 dB, to pins 7/8.
   Using potentiometer R28, set V_{dc} to 160 mV $\pm$ 1 mV.
   Repeat 1 and 2 until both values are correct.

3. Setting the gain for Z = 900 Ω
   Connect pin 11 to ground, disconnect pins 10 and 12.
   Apply V_{in}, 1 kHz, - 34.24 dB, to pins 7/8.
   Use potentiometer R5 to set the voltage at pins 28/29, V_{dc} to 4.00 V

4. Setting the gain for ▼ II
   Connect pin 10 to ground, disconnect pins 11 and 12.
   Apply V_{in}, 1 kHz, - 34 dB, to pins 7/8.
   Use potentiometer R3 to set the voltage at pins 28/29 V_{dc} to 4.00 V.

4.6.2.5 Checking the changeover of the rectifier time constant

Connect pin 12 to ground, disconnect pins 10 and 11.
Apply V_{in}, 200 Hz - 36 dB, to pins 7/8.
Measure the voltage at pins 28/29 with the oscilloscope.

1. At pin 30 apply + 12.5 V.
   Maximum ripple of voltage V_{dc}: 150 mV_{pp}

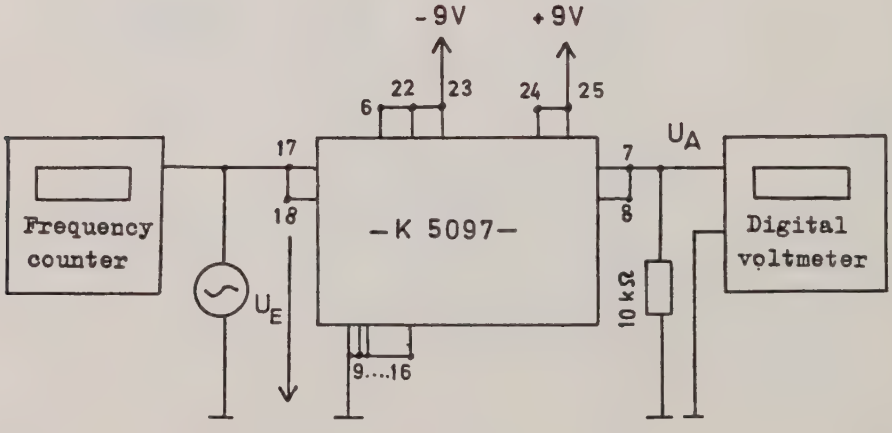
2. Disconnect voltage from pin 30.
   Maximum ripple of voltage V_{dc}: 400 mV_{pp}

4.6.3. f/V converter -K 5097-

4.6.3.1 Test equipment required

1 signal generator 200 Hz - 4 kHz
(e.g. built-in generator or 3 W 217)
1 oscilloscope
1 frequency counter
1 digital voltmeter
1 multimeter

4.6.3.2 Connections



4.6.3.3 Current drain

+ 9 V ... I = 14 to 20 mA

- 9 V ... I = 10 to 15 mA

4.6.3.4 Functional testing

Connect a voltage V_{in} to pins 17/18.

Level: 0 dB, f = 4 kHz.

Test the correct functioning of the individual components with the oscilloscope by reference to the circuit diagram.

Readjustment is necessary if components are changed.

4.6.3.5 Setting the gain

The gain is set in conjunction with the complete unit and is described in 4.6.14.4.

The preliminary adjustment on the module can be carried out as follows:

1. V_{in}:level 0 dB, frequency f = 4000 Hz
   (check with the frequency counter !)
   Use potentiometer R18 to set the voltage V_{out} to 4 V $\pm$ 5 mW.

2. V_{in}: level 0 dB, frequency f = 200 Hz
   Use potentiometer R24 to set the output voltage V_{out} to 200 mV.

Repeat 1 and 2 until both values are correct.

4.6.3.6 Checking the dynamic range of the input level

Reduce the level of input voltage V_{in}:

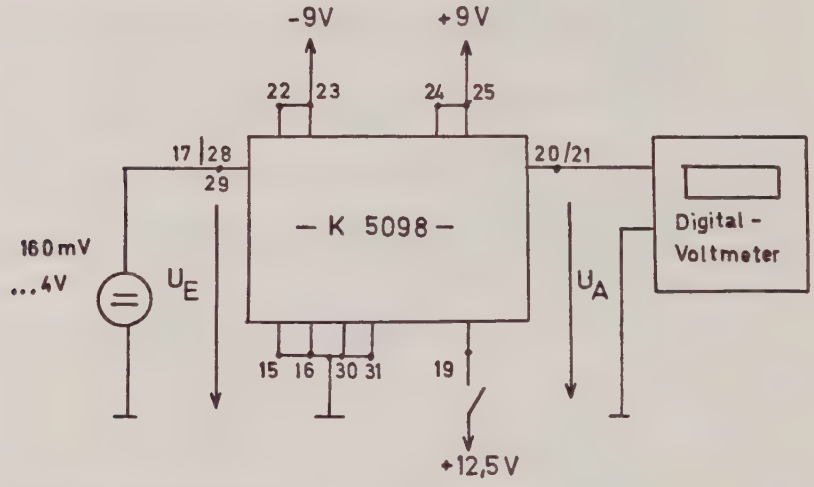
With an input level of - 30 dB, output voltage V_{out} must be $\leq$ 3.2 V for f = 4 kHz and $\leq$ 80 mV for f = 200 Hz.

4.6.4 Logarithmic amplifier -K 5098-

4.6.4.1 Test equipment required

1 digital voltmeter
1 multimeter
1 dc voltage source
(adjustable 160 mV to 4 V)

4.6.4.2 Connections



4.6.4.3 Current drain

+ 9 V ... I = 5 to 8 mA
- 9 V ... I = 5 to 8 mA

4.6.4.4 Setting the gain

1. V_{in} = 4 V (check with digital voltmeter)
   Use potentiometer R6 to set the voltage V_{out} to 4 V $\pm$ 5 mV.

2. V_{in} = 160 mV
   Use potentiometer R17 to set the voltage V_{out} to 500 mV.
   Carry out 1 and 2 alternately until both values are correct.

4.6.4.5 Testing the functioning of relay Z4

Apply + 12 V to pin 19.

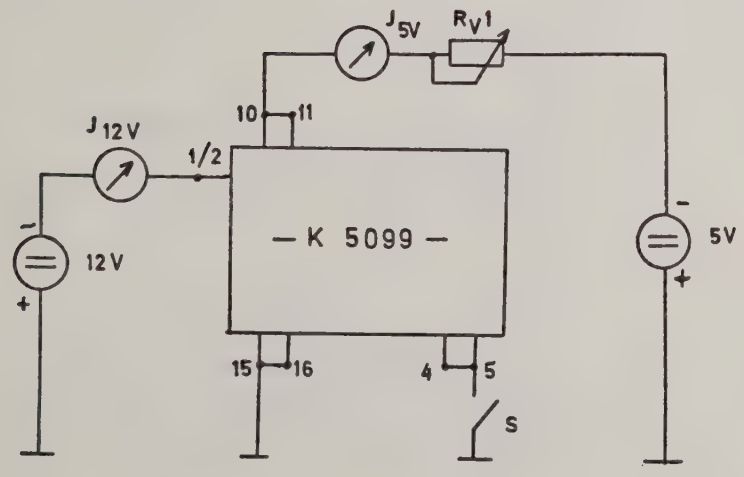
For any voltage V_{in} 160 mV to 4 V, V_{out} must equal V_{in}.

4.6.5 Battery charging circuit -K 5099-

4.6.5.1 Test equipment required

1 5 V dc voltage source
1 8 to 16 V dc source
2 12 V batteries
2 multimeters
1 dropping resistor R_{v1} (adjustable up to 1 kΩ)
1 dropping resistor R_{v2} (adjustable up to 50 kΩ)

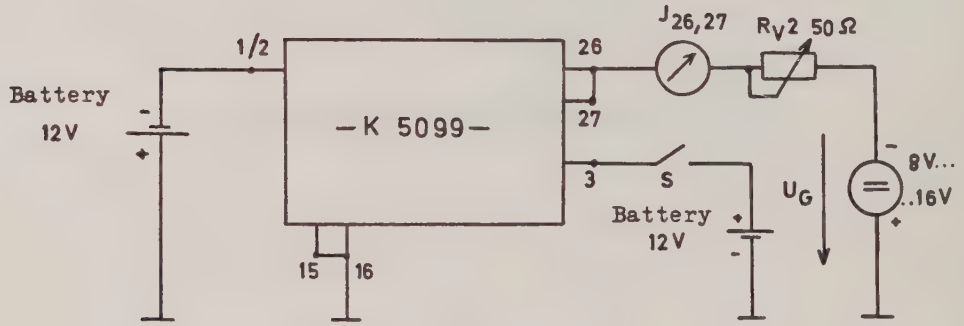
4.6.5.2 Connections for functional testing



1. Connect pins 4/5 to ground (switch S).
   Use R_{v1} to set I_{5V} to 15 mA.
   Nominal value of I_{12V} : 0.5 to 1.5 mA.
   Measure the voltage at the anode of diode Gr1.
   Nominal value: 5.9 to 6.5 V.

2. Disconnect ground from pins 4/5.
   Nominal value: I_{5V} = 0 mA.

4.6.5.3 Connections for checking the constant current source



1. Open switch S (pin 3 disconnected).
   Set dc voltage V_{dc} to 8 V.
   Nominal value of current $I_{26/27} \leq 1$ mA.

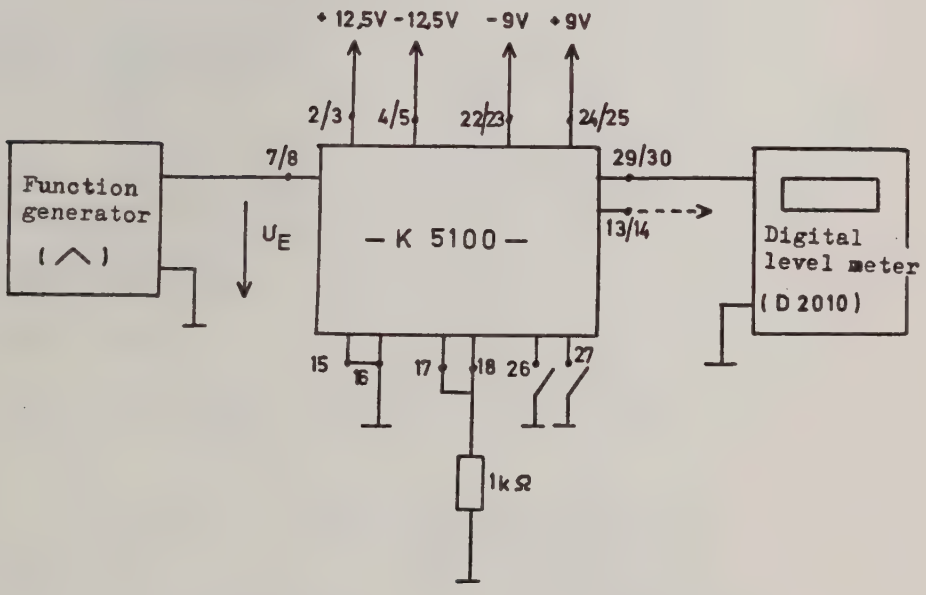
2. Set R_{v2} to 50 Ω maximum value.
   Increase V_{dc} to 16 V.
   Use R_{v2} to current $I_{26/27}$ to 150 mA.
   When switch S is closed (+ 12 V applied to pin 3)
   current $I_{26/27}$ must not be greater than 1 mA.

4.6.6 Output amplifier -K 5100-

4.6.6.1 Test equipment required

1 function generator (triangular voltage waveform 200 Hz to 4 kHz)
1 digital level meter (e.g. D 2010/D2014)
1 digital voltmeter
1 oscilloscope

4.6.6.2 Connections



4.6.6.3 Current drain

+ 9 V ... I = 0.6 to 0.9 mA
- 9 V ... I = 0.6 to 0.9 mA
+ 12.5V... I = 9 to 13 mA
- 12.5 V ... I = 9 to 13 mA

4.6.6.4 Setting the operating points

The emitter voltage of transistors Ts1 and Ts2 must be measured with the digital voltmeter.

Set V_{ETS1} to - 3.40 V using potentiometer R3 and V_{ETS2} to + 3.40 V using potentiometer R_{28}.

4.6.6.5 Setting the gain

Apply a triangular voltage waveform f = 1 kHz to pins 7/8. Use the digital level meter to measure this voltage and set a level of + 12.88 dB ($\simeq$ 13 V_{pp}).

(This voltage can also be taken from the output of the f/V converter of the level tracer, module -K 5097- pins 7/8).

1. Connect pin 27 to ground.
   Disconnect pin 26.
   Measure the voltage at pins 29/30: use potentiemeter R35 to set this voltage to a level of + 13 dB.
   On checking the output voltage with an oscilloscope distortion of the sine wave must not be visible.

   Measure the voltage at pins 13/14.
   Nominal value: level = + 10.60 to + 10.70 dB.

2. Connect pin 26 to ground.
   Disconnect pin 27.
   Use potentiometer R33 to set the level of the voltage at pins 29/30 to + 14.75 dB.

4.6.6.6 Testing the functioning of relays E and F

When a dc potential of + 12 V is applied to pin 12, there must be continuity between pins 21 and 17/18, and an open circuit when the voltage is removed from pin 12.

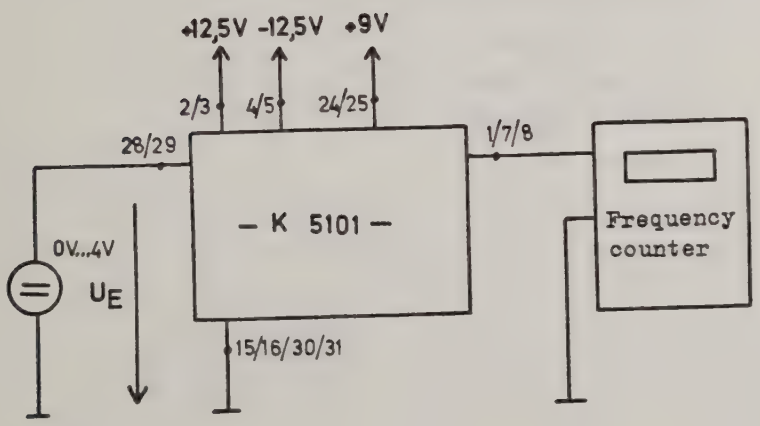
When a dc potential of + 12 V is applied to pin 19, there must be continuity between pins 20 and 17/18, and an open circuit when the voltage is removed from pin 19.

4.6.7. V/f converter -K 5101-

4.6.7.1 Test equipment required

1 frequency counter
1 digital voltmeter
1 digital level meter
(e.g. D 2010/D 2014)
1 oscilloscope
1 multimeter
1 dc voltage source
(adjustable from 0 to 4 V)

4.6.7.2 Connections



4.6.7.3 Current drain

+ 12.5 V ... I = 11 to 17 mA
- 12.5 V ... I = 10 to 15 mA

4.6.7.4 Setting the gain

V_{in} = 500 mV (check with digital voltmeter).
Use an oscilloscope to check the triangular waveform at the output. A voltage V_{pp} of - 13 V should be displayed.
This voltage must have a level of + 12.88 dB when measured with a digital level meter (set with potentiometer R26).

4.6.7.5 Setting the V/f ratio

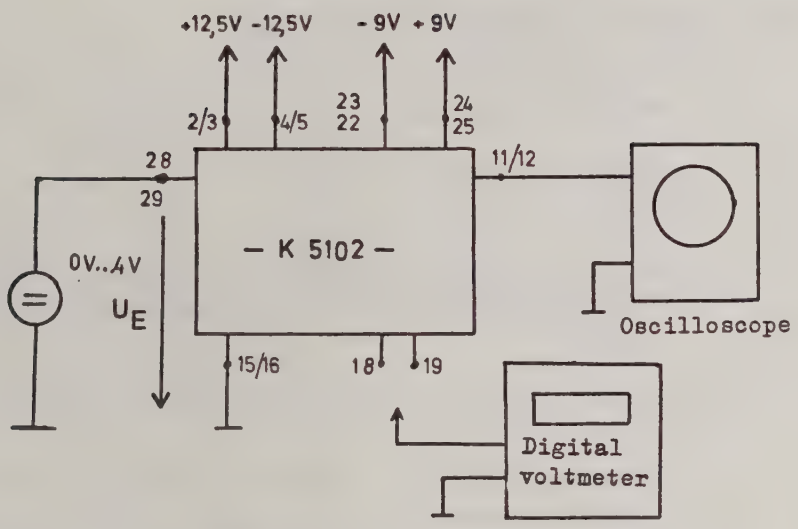
With V_{in} = 500 mV, use R38 to set the frequency of the output voltage to f_{out} = 500 Hz.

4.6.8. Frequency suppression -K 5102-

4.6.8.1 Test equipment required

1 dc voltage source
(adjustable from 0 to 4 V)
1 digital voltmeter
1 oscilloscope

4.6.8.2 Connections



4.6.8.3 Current drain

+ 12.5 V ... I = 5 to 9 mA
- 12.5 V ... I = 5.5 to 7.5 mA
+ 9 V ... I = 5 to 8 mA
- 9 V ... I = 1.5 to 3 mA

4.6.8.4 Functional testing

A triangular voltage waveform between 0.2 V and 4 V (frequency $\simeq$ 1 Hz) is applied to pins 28/29. This voltage can be taken from the output of the sweep generator -K 5103- of the level tracer (module -K 5103-, pins 30/31). The voltage waveform must be checked at the points marked on the circuit diagram.

4.6.8.5 Setting the gain

1. Apply V_{in} = 4 V dc to pins 28/29 (check with the digital voltmeter). Use potentiometer R26 to set the output voltage at pins 11/12 to 4.00 V.

2. Apply V_{in} = 200 mV.
   Use potentiometer R20 to set output voltage V_{out} to 200 mV.

Repeat 1 and 2 alternately until both values are correct.

4.6.8.6 Setting the suppressed frequencies

1. Check the + 9 V potential with the digital voltmeter.
   Set to 9 V $\pm$ 10 mV.

2. Measure the voltage at pin 18 with the digital voltmeter:

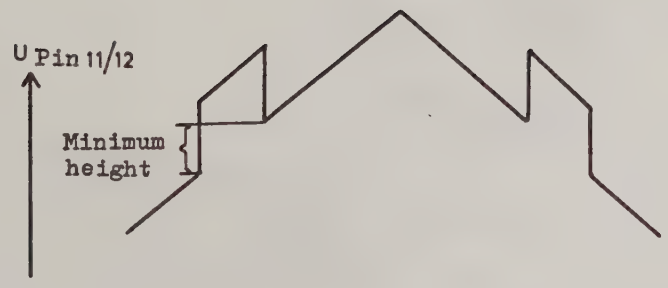
   Use potentiometer R2 to set this voltage to 2.68 V $\pm$ 30 mV (corresponding to a suppressed frequency of 2.6 kHz)

3. Measure the voltage at pin 19 with the digital voltmeter:
   Use potentiometer R5 to set this voltage to 3.10 V $\pm$ 50 mV (corresponding to a suppressed frequency of 3.0 kHz. If other frequencies are to be suppressed, set potentiometers R2 and R5 to correspond to these frequencies).

4.6.8.7 Setting the suppression band

Connect pin 18 (or 19) to pin 20.
Connect pins 28/29 as in 4.6.8.4.
Examine the voltage at pins 11/12 with the oscilloscope.
The width of the suppression pulse (corresponding to the suppressed frequency range) can be set with potentiometer R9.

The height of the suppression pulse is set with potentiometer R22 and must be large enough to ensure that the suppressed range is not swept.



4.6.9. Sweep generator -K 5103-

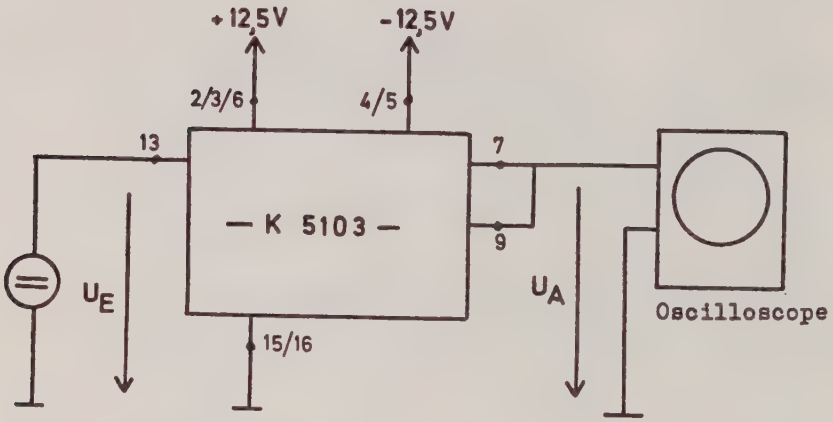
4.6.9.1 Test equipment required

1 digital voltmeter
1 oscilloscope
1 multimeter
1 dc voltage source
(adjustable from 0 to ± 4 V)

4.6.9.2 Functional check

Connect the module to the level tracer via an adapter.
Switch positions:
S 9 ... "Sweep"
Use the oscilloscope to check the waveforms at the points given in the circuit diagram.

4.6.9.3 Connections for setting the sweep section



4.6.9.4 Current drain

1. Multivibrator state "1"
   Apply V_{in} = + 3 V to pin 13.
   + 12.5 V ... I = 8.5 to 15 mA
   - 12.5 V ... I = 2.5 to 8 mA

2. Multivibrator state "2"
   Apply V_{in} = - 3 V to pin 13.
   + 12.5 V ... I = 5 to 10 mA
   - 12.5 V ... I = 8.5 to 15 mA

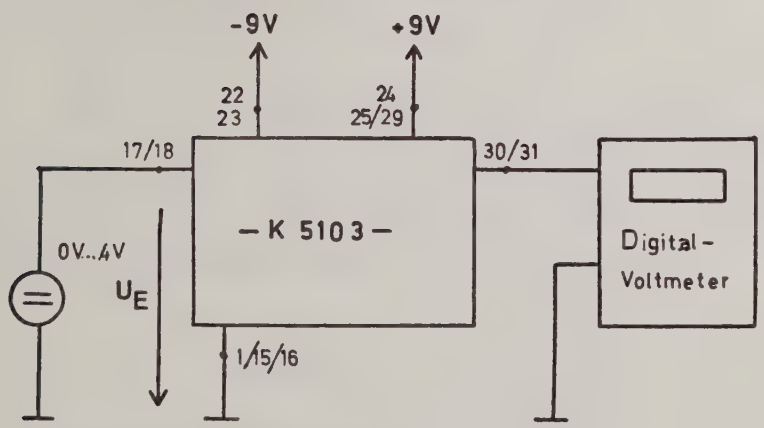
4.6.9.5 Determining the triggering points

1. Determining $V_{in\ trig.\ 1}$
   When an input voltage of - 3 V is applied to pin 13, a voltage $V_{out\ 1} \simeq$ - 9 V must appear at the output (pin 7). This voltage remains when V_{in} = 0 V is applied. If the voltage V_{in} is then increased in the positive direction, at a certain input voltage $V_{in\ trig.1}$ the output voltage $V_{out\ 1}$ jumps from - 9 V to + 9 V.

The trigger voltage $V_{in\ trig.1}$ shall lie between + 2.2 V and + 2.6 V; the exact value must be determined (with the digital voltmeter). It is required for subsequent setting of the lin/exp. function converter.

2. Determining $V_{in\ trig.2}$
   Apply V_{in} = + 3 V to pin 13. As a result V_{out} = + 9 V must appear. V_{in} = 0 V is then applied to pin 13 and the voltage increased in the negative direction. At a voltage $V_{in\ trig.2}$ the output voltage jumps from + 9 V to - 9 V. The voltage $V_{in\ trig.2}$ must lie between -2.2 V and -2.6 V. The exact value must be determined.

4.6.9.6 Connections for setting the lin/exp. function converter



4.6.9.7 Current drain

+ 9 V ... I = 5 to 7 mA
- 9 V ... I = 5 to 7 mA

4.6.9.8 Setting the gain

1. Connect V_{in} = 0 V to pin 13.
   Use potentiometer R17 to set V_{out} to 894 mV.

2. Apply $V_{in} = V_{in\ trig.2}$ (from measurement 4.6.9.5.)
   to pin 13. Use potentiometer R22 to set V_{out} to + 4 V
   $\pm$ 10 mV.

3. Apply $V_E = V_{in\ trig.1}$ (from measurement 4.6.9.5.)
   to pin 13. Use poteniometer R17 to set V_{out} to 200 mV.
   Carry out 2 and 3 alternately until the two values
   are correct.

4.6.9.9 Checking the functioning of relays A and B

Connect the module in accordance with 4.6.9.3.

1. Apply V_{in} = - 3 V to pin 13. There must then be
   continuity between pins 19 and 21 as well as 26
   and 28, and an open circuit between pins 20 and 21 as
   well as 27 and 28.

2. Leave V_{in} = - 3 V applied to pin 13.
   Apply + 12.5 V to pin 12.
   There must then be an open circuit between pins 19
   and 21 as well as 26 and 28 and continuity between
   pins 20 and 21 as well as 27 and 28 (relays A and B
   operated).

3. Apply V_{in} = + 3 V to pin 13.
   Disconnect pin 12.
   Relays A and B must then release (see 1.).

4.6.9.10 Setting the sweep rate

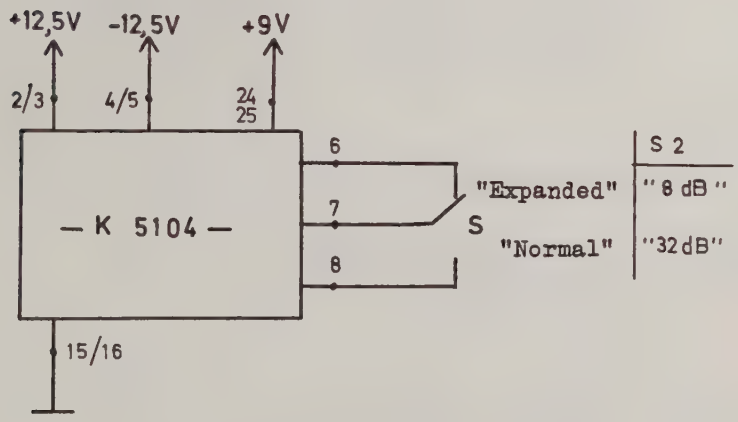
Connect the module as in 4.6.9.2.
Switch position S9:
Set "Sweep 1 s" with potentiometer R8.
Switch position S9:
Set "Sweep 4 s" with potentiometer R27.

4.6.10 Frequency marker -K 5104-

4.6.10.1 Test equipment required

1 oscilloscope
1 multimeter

4.6.10.2 Connections



4.6.10.3 Current drain

+ 12.5 V ... I = 4 to 7 mA
- 12.5 V ... I = 4 to 7 mA

4.6.10.4 Functional check

Check the voltage waveforms given in the circuit diagram.

4.6.10.5 Checking the status of transistors Ts2, Ts3, Ts4, Ts5

The resistance between the drain and source of the transistors must be measured with a multimeter in accordance with the circuit diagram:
Turned on R $\leq$ 1 kΩ, turned off R $>$ 1 MΩ

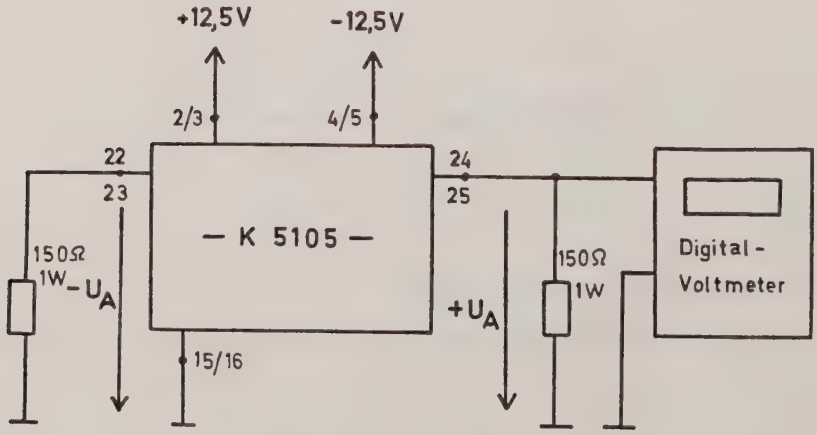
1. Connect pin 1 to ground.
   Disconnect pins 24/25, 6, 7 and 8. The following must then be obtained:
   Emitter voltage of Ts8 + 7 V
   Emitter voltage of Ts7 - 8.5 V
   Ts2 and Ts4 must be turned on and
   Ts3 and Ts5 turned off.

2. Connect pin 1 to - 6 V.
   The following must then be obtained:
   Emitter voltage of Ts8 - 8.5 V
   Emitter voltage of Ts7 + 8.5 V
   Transistors Ts2 and Ts4 must be turned off and
   Ts3 and Ts5 turned on.

4.6.11 Regulator section -K 5105-

4.6.11.1 Test equipment required

1 digital voltmeter
2 load resistors 150 Ω, 1 W



4.6.11.3 Setting the output voltage

Set + V_{out} (voltage at pins 24/25) with potentiometer R20 to + 9.00 V.
Set - V_{out} (voltage at pins 22/23) with potentiometer R23 to - 9.00 V.

4.6.11.4 Checking the regulation

When the voltages at pins 2/3 and 4/5 are varied between (±) 11 V and (±) 15 V, the corresponding output voltage (±) V_{out} must vary by not more than 10 mV.

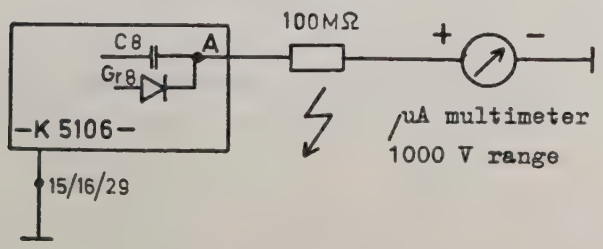
4.6.12. High-voltage converter -K 5106-
Horizontal amplifier

4.6.12.1 Test equipment required

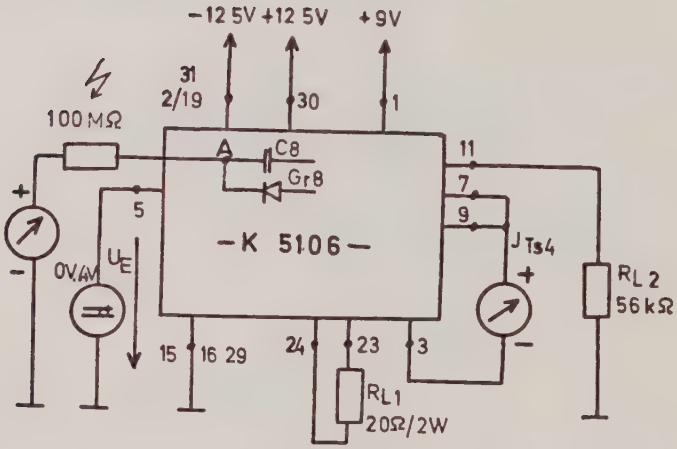
1 oscilloscope
1 mA multimeter
2 µA multimeters
1 dropping resistor 100 MΩ
1 load resistor RL_1 = 20 Ω/2 W
1 load resistor RL_2 = 56 kΩ/0.5 W
1 dc voltage source (adjustable from 0 to 4 V)

4.6.12.2 Connections

Caution: Before the supply voltages are applied to the module the following connection must be made from the anode voltage terminal (point A) to ground.



This connection is made to a potential of 2100 V; the regulations for working with high voltages must be complied with. Do not interrupt the connection as long as the supply voltage is connected.
Do not change the multimeter range !
After removal of the supply voltages, wait 5 seconds before interrupting the connection (capacitor charge!)



4.6.12.3 Current drain

+ 12.5 V ... I ≤ 210 mA
- 12.5 V ... I ≤ 225 mA

4.6.12.4 Checking the ac voltage generated

Measure the voltage at the collector of Ts1 with the [redacted]scope. The [redacted], the waveform should agree with the data in the circuit diagram.

4.6.12.5 Checking the dc voltages

Measure the dc voltages with a µA multimeter.
Nominal voltages: pin 11 = + 140 V to + 160 V
pin 21 = - 850 V to - 1000 V
pin 22 = [redacted] R15 to - 990 V.

Voltage indication on the multimeter with a 100 MΩ dropping resistor

Nominal value: [redacted] V.

4.6.12.6 Checking the horizontal amplifier

Current I_{Ts4}: 1.5 to 1.9 mA.
Depending on the input voltage V_{in} the following voltages must be measured with the multimeter at pins 4 and 10:

V_E (mV)	200	2000	4000
V_A at pin 10 (V)	33 to 48	71 to 87	119 to 137
V_A at pin 4 (V)	102 to 138	64 to 99	16 to 50

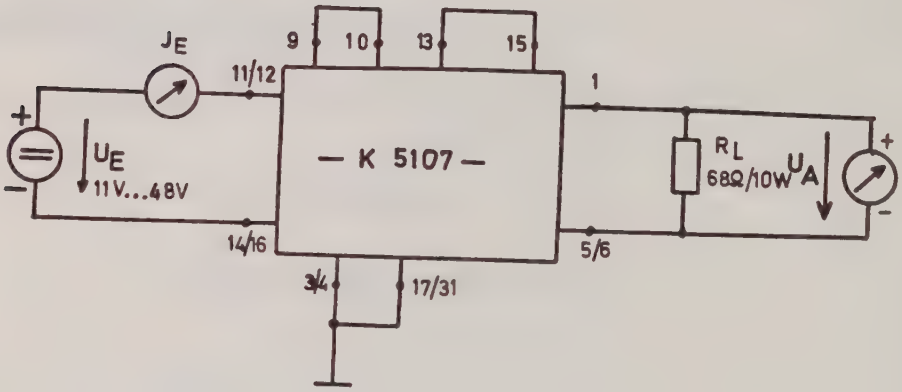
4.6.13. Converter -K 5107-

Vertical amplifier

4.6.13.1 Test equipment required

1 oscilloscope
1 mA multimeter
1 µA multimeter
1 12 V battery
1 dc source (adjustable from 11 to 48 V)
1 dc source (adjustable from 0 to 4 V)
1 load resistor R_L = 68Ω/10 W

4.6.13.2. Connections for setting the converter



4.6.13.3. Setting the output voltage

Connect pin 9 to pin 10 and pin 13 to pin 15.

Apply V_{in} = 12 V between pins 11/12 and 14/16.

[redacted] $_{out}$ to 25 V.

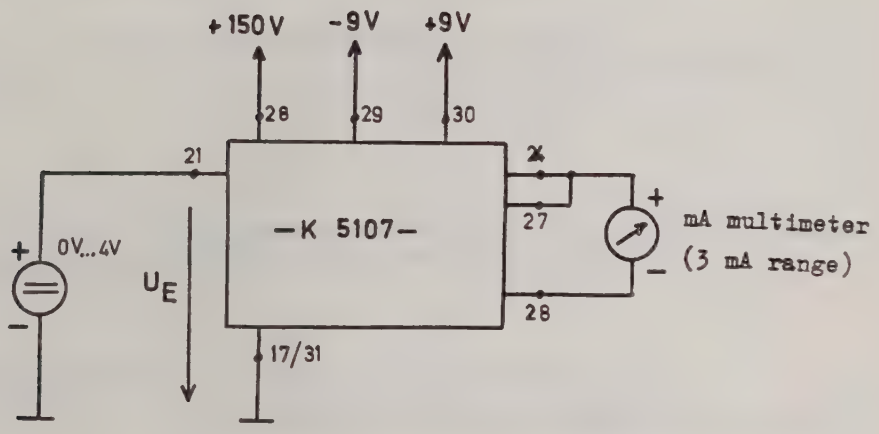
4.6.13.4. Current drain

Connections as for 4.6.13.3.

V_{in} = 12.0 V ... $I_{in} \leq$ 1.1 A

V_{in} = 48 V ... $I_{in} \leq$ 0.3 A

4.6.13.5 Connections for checking the vertical amplifier



4.6.13.6 Current drain

A current of 1.3 mA to 1.6 mA shall flow between pins 24, 27 and 28.

4.6.13.7 Setting the gain

When a voltage of + 3.5 V is applied to pin 21, the following voltages shall be measured with a µA multimeter:

pin 19: + 64 V to + 85 V
pin 20: + 83 V to + 104 V

The gain is set in conjunction with the complete unit and is described in 4.6.14.3.2.

4.6.14. Settings on the complete unit

4.6.14.1 Setting the supply voltages

AC operation
Switch position: S12 "AC operation"

On the internal wiring (accessible after removal of the bottom plate) the following voltages must be measured at the marked solder terminals:

Pins 2 and 3: + 12.5 V with respect to ground
Pins 4 and 5: - 12.5 V with respect to ground

If these voltages deviate by more than ± 0.5 V from the nominal values, adjust module -K 5107- (converter) in accordance with 4.6.13.

Pins 24 and 25: + 9 V

If this deviates by more than ± 5 mV, adjust with [illegible].

Pins 22 and 23: - 9 V

[illegible] potentiometer [illegible].

4.6.14.2 Adjusting the generator section

4.6.14.2.1 Test equipment required

1 frequency counter
1 digital voltmeter
1 distortion bridge
1 digital level meter, e.g. D 2010

4.6.14.2.2 Adjusting the frequency scale

Switch positions:
S3...."Leveling"
S6 ... "+ 10 dB"
S7 ... "0 dB"
S8 ... "600 Ω, Ri = 0"
S9 ... "Manual control"
S11... "Without frequency suppression"

A. Adjustment at 200 Hz:

Set the frequency scale to 200 Hz.
On connector A of the internal wiring under the frequency setting potentiometer (accessible after removal of the bottom plate) measure the voltage at pin A 21 with a digital voltmeter.

Set this voltage with potentiometer R2 of module -K 5110- (accessible from above, located above the potentiometer for setting the frequency) to 200 mV.

Measure the output frequency of the generator with a frequency counter and set with potentiometer R36 of module -K 5101- (V/f converter) to 200 Hz.

B. Adjustment at 4 kHz

Set the frequency scale to 4 kHz.
Set the voltage at pin A 21 with potentiometer R8 of module -K 5110- to 4 V. Set the output frequency of the generator by varying capacitor C11 on module -K 5101- (increased capacitance, higher frequency).

4.6.13.2.3 Adjusting the output level

Switch positions:
S6 ... "0 dB"
S7 ... "0 dB"
S8 ... "600 Ω, Ri = 0"
S9 ... "Manual control"
Set a frequency of 1 kHz.

A. Setting the output level for 600 Ω:

[redacted] amplifier) to set the output level of the generator to 0 dB.

B. Setting the output level for 900 Ω:

Set S8 to position "900 Ω, Ri = 0".

[redacted] potentiometer R33 of module -K 5100- to set the output level of the generator to + 1.76 dB.

4.6.14.2.4 Adjusting the distortion factor

Switch positions:
S6 ... " + 10 dB"
S7 ... " 0 dB"
S8 ... "600 Ω, Ri = 0"

The distortion factor is adjusted with potentiometer R13 of module -K 5101- (V/f converter) as well as potentiometers [redacted] that the total distortion measured at the generator output is a minimum.

4.6.14.3 Adjusting the receiver

4.6.14.3.1 Test equipment required

1 frequency counter
1 digital voltmeter
1 digital level meter (e.g. D 2010)

The built-in generator section of the level tracer is used to adjust the receiver; it is advisable to first check its adjustment in accordance with 4.6.14.2.

4.6.14.3.2 Setting the vertical amplifier -K 5107-

Switch positions:
S1 ... "Generator"
S3 ... " ▼ I"
S9 ... "Manual control"

A. Switch S2: "32 dB"

On the connector of module -K 5096- (amplifier) measure the voltage at pins 28/29 with the digital voltmeter.

Set this voltage with potentiometer R19 of module -K 5096- to + 2.58 V. When this voltage is obtained, set the light spot on the screen to the 0 dB line using calibration potentiometer P3 (▼ I).

B. Switch S2: "8 dB"

If the light spot moves when S2 is changed over, adjust the gain with potentiometer R19 of module -K 5107- (vertical amplifier) so that no shift occurs.

C. Switch S3: " ▼II"

Switch S2: "32 dB"

Use calibration potentiometer P4 (▼ II) to set the light spot to the calibration line ▼ II on the screen.

D. Switch S2: " 8 dB"
Switch S3: " ▼ II"

Use potentiometer R19 of module -K 5107- to set the light spot on the expanded scale to - 6 dB.

4.6.14.3.3 Setting the horizontal amplifier -K 5106-

Switch positions:
S1 ... "Generator"
S3 ... "▼ I"
S9 ... "Manual control"

A. Use the manual control to set the output frequency to 4 kHz and check with a frequency counter. Using potentiometer P1 (on the front panel) set the light spot to the 4 kHz line of the graticule. Subsequently rotate potentiometer P2 (on the front panel). If the light spot moves, set potentiometer R10 on module -K 5106- so that rotation of P2 has no effect on the position of the light spot.

B. Set an output frequency of 200 Hz.
Using potentiometer P2, set the light spot to the 200 Hz line of the graticule.

4.6.14.4 Adjusting the f/V converter -K 5097-

4.6.14.4.1 Test equipment required

1 frequency counter

4.6.14.4.2 Setting the gain

Switch positions:
S2 ... "32 dB"
S3 ... "▼ I"
S9 ... "Manual control"
S11 ... "Without frequency suppression"

A. Use the manual control to set the output frequency to 4 kHz and check with the frequency counter. Set potentiometer R18 on module -K 5097- (f/V converter)

so that the light spot on the screen does not shift when switch S1 is changed over from "Generator" to "Receiver".

B. Set an output frequency of 200 Hz.
Set potentiometer R24 of module -K 5097- so that the light spot on the screen does not shift when switch S1 is changed over from "Generator" to "Receiver".

Carry out A and B alternately until both are correct.

4.6.15 Changing and mechanical adjustment of the cathode-ray tube

If the cathode-ray tube is changed, carry out adjustment as follows:

Switch positions:
S1: "Rec. and Freq. Marker"
S2: "32 dB"
S3: "▼ I"
S9: "Manual control"
Frequency scale to 4 kHz
S11: "Without frequency suppression"

4.6.15.1 Setting the geometry

Use potentiometer R20 on module -K 5106- (high-voltage converter) to linearize the vertical frequency marker.

4.6.15.2 Aligning the verticals

Rotate the CRT to align the frequency marker with the vertical graticule line.

4.6.15.3 Presetting the intensity

Switch positions:
S1: "Generator"
Rotate P6 for minimum intensity.
Using potentiometer R15 on -K 5106-, set the intensity so that the light spot is just not visible.

4.6.15.4 Setting the focus and astigmatism

Turn P6 for normal intensity. Using P7 (focus) and potentiometer R19 on -K 5106- (astigmatism) set as the smallest possible circular light spot.

5. STÜCKLISTE

Vorbemerkung

Unter Symbol stehen die in den Stromläufen verwendeten Abkürzungen für die Bauteile in alphabetischer und - soweit möglich - in numerischer Reihenfolge. Mit Stück ist die Anzahl der gleichen Bauteile innerhalb der Geräte oder der Baugruppe bezeichnet. In der Spalte Gegenstand sind ausser dem Namen des Bauteils auch seine Hauptkennwerte angegeben. Mit der Bestellnummer ist das Bauteil durch einen Abkürzungs-Code oder eine Bauvorschrift eindeutig gekennzeichnet.

Es bedeuten:

bei einem Widerstand: 300 kΩ ±5 %; 0,5 W
- 300 kΩ . . . . . Nennwert des Widerstandes
- ±5 % . . . . . Toleranz des Nennwiderstandes
- 0,5 W . . . . . Belastbarkeit bezogen auf Umgebungstemperatur 20°C

bei einem Kondensator: 1000 pF ±20 %; 125 V-
- 1000 pF . . . . . Nennwert der Kapazität (1 pF = µµF = 10^{-12} F)
- ±20 % . . . . . Toleranz der Nennkapazität
- 125 V- . . . . . zulässige Betriebsgleichspannung

bei einem Übertrager:

Wicklg.I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	
228 µH ±2 %	720 Wdg HFL SS 60x0,03 35Ω
Abgriff(2a): 210 Wdg	1.Abgriff (gesw): 46 Wdg
	2.Abgriff (rtgn): 190 Wdg

Wicklg.I (1a,2a,3a)
- 440 Wdg . . . . . 440 Windungen, Anfang Lötöse 1a, Ende 3a;
- 0,1 CuL . . . . . aus Kupferdraht (Cu); 0,1 mm Ø; lackisoliert (L)
- 75 Ω . . . . . Gleichstromwiderstand der Wicklung I
- 228 µH . . . . . Induktivität
- Abgriff(2a): 210 Wdg . . Abgriff bei der 210.Windung, Lötöse 2a

Wicklg.II — sinngemäss wie bei Wicklung I
- HFL SS 60x0,03 . . . . . Hochfrequenzlitze 2fach seidenumsponnen (SS), aus Kupferdraht 60x0,03 mmØ

bei einem Gleichrichter: 50 V/250 mA
- 50 V . . . . . Anschluss-Wechselspannung
- 250 mA . . . . . entnehmbarer Betriebsstrom

+ Farbkurzzeichen
bl = blau ge = gelb gr = grau sw = schwarz rs = rosa
br = braun gn = grün rt = rot ws = weiss rtsw = rot/schwarz

5. P A R T S L I S T

Introductory remark

The "SYMBOL" column shows the abbreviations used in the circuit diagrams in alphabetic and, to the extent possible, numerical order. "QTY" denotes the number of identical components within the devices or the subassembly. The "DESCRIPTION" column gives, apart from the designation of the components, its principal characteristic data. The "ORDER NUMBER" column designates the component nonambiguously by an abbreviation code or a component specification.

There denotes, for instance

with a resistor:	300 kΩ ±5%; 0,5 W
300 kΩ	Nominal value of the resistance
±5%	Tolerance of the nominal resistance
0,5 W	Wattage rating, as referred to an ambient temperature of 20°C
with a capacitor:	1000 pF ±20%; 125 V-
1000 pF	Nominal value of the capacitance (1 pF = 1 µµF = 10^{-12} F)
±20%	Tolerance of the nominal capacitance
125 V-	Permissible DC operating voltage

with a transformer:

Wicklg. I(1a,2a,3a)	Wicklg. II(rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	720 Wdg HFL SS 60x0,03 35 Ω
228 µH ±2%	1.Abgriff(gesw): 46 Wdg
Abgriff(2a): 210 Wdg	2.Abgriff(rtgn): 190 Wdg

Wicklg.I(1a,2a,3a)	
440 Wdg	440 turns, start soldering lug 1a, end 3a
0,1 CuL	of copper wire (Cu); 0.1 mm dia., enamelled (L)
75 Ω	DC resistance of winding I
228 µH	Inductance
Abgriff(2a):210Wdg	Tap at soldering lug 2a at the 210th turn
Wicklg. II . . .	Analogously to winding I
HFL SS 60x0,03 .	RF copper Litz wire, with double silk covering, 60x0.03 mm dia.
with a rectifier:	50 V/250 mA
50 V	Primary AC voltage
250 mA	Available operating current

+Color symbols

bl = blue	ge = yellow	gr = gray	sw = black	rs	= pink
br = brown	gn = green	rt = red	ws = white	rtsw	= red/black

Pegelsichtgerät 200 Hz bis 4 kHz S45034-K2001-A204
LEVEL TRACER 200 Hz to 4 kHz S45034-K2001-A204

Symbol SYMBOL	Stück QTY	Gegenstand DESCRIPTION	Bestellbezeichnung ORDERING DATA	Seite PAGE
	1	Umrüstsatz OPTION	S45034-K3010-A701	5-3
	1	Relais-Baugruppe RELAY SUBASSEMBLY	S45035-K5094-A701	5-3
	1	Verstärker AMPLIFIER	S45035-K5096-A701	5-4
	1	f/U-Wandler F/U CONVERTER	S45035-K5097-A701	5-4
	1	Logarithmierer LOG CONVERTER	S45035-K5098-A731	5-4
	1	Batt.-Ladeschaltung CHARGER FOR BATTERY	S45035-K5099-A701	5-5
	1	Sendeverstärker TRANSMITTING AMPLIFIER	S45035-K5100-A701	5-5
	1	U/f-Wandler U/F CONVERTER	S45035-K5101-A701	5-5
	1	Wobbelgenerator SWEEP GENERATOR	S45035-K5103-A701	5-6
	1	Regelteil REGULATING SECTION	S45035-K5105-A701	5-7
	1	Hochspg.-Wandler HIGH-VOLTG CONVERTER	S45035-K5106-A701	5-7
	1	Sperrwandler DC/DC CONVERTER	S45035-K5107-A701	5-7
	1	Querverdrahtung 1 CROSS WIRING 1	S45035-K5108-A701	
	1	Querverdrahtung 2 CROSS WIRING 2	S45035-K5104-A701	
	1	Meßfeld MEAS FIELD	S45035-K5110-A201	5-8
	1	Netzteil POWER SUPPLY UNIT	S45035-K5111-A701	5-9
		Schichtwiderstand LAYER-TYPE RESISTOR		
R1	1	68kOhm 2% 0,35W	B54322-A4683-G1	
		Schichtdrehwiderstand LAYER TYPE VAR RESISTOR		
P6	1	1MOhm	W40101-G5105-N1	
P7	1	100kOhm	W40101-G8204-N1	
		Tantal-Elko TANTAL CAPACITOR		
C2	1	39 µF 20% 60V	B45265-A7396-M	
		Diode DIODE		
Gr1	1	SSi B0140	C66047-A1003-A4	
		Knebelknopf SWITCH KNOB		
	4	(für S1,2,9,12) (FOR S1,2,9,12)	H60502-A623-A1	
	6	(für S3...S8) (FOR S3...S8)	H60502-A631-A1	
		Drehknopf KNOB		
	1	(für P5) (FOR P5)	H60501-A1410-X1	
	1	(für P8) (FOR P8)	C44249-A125-B42	
	1	(für P8) (FOR P8)	C44106-A12-C1	
		Zeckel CAP		
	4	(für S1,2,9,12) (FOR S1,2,9,12)	H60502-T23-G	
	6	(für S3...S8) (FOR S3...S8)	H60502-T31-G	
	1	(für P5) (FOR P5)	H60501-T10-G	
		Drehschalter TURNSWITCH		
S11	1		C40315-M303-A1	
S12	1		C40315-M163-S228	
		Lampe LAMP		
Lp4,5	4	Fg lp 62 f	C30230-F62-A6	
Lp1,2,3	3		C44230-Z6-C4	
		Bildrohr CATHODE RAY TUBE		
	1	D13/41GM Fa. Telefunken	Q71-X425	
	1	Skalenvorsatz MASK	C44249-A125-B6	
	1	Skalenscheibe GRATICULE SCREEN	C44249-A125-B40	
	1	Filter FILTER	C44249-A125-C94	
	1	Netzanschlußltg. POWER CORD	V45504-F4-A222	
	1	Batt.-Anschlußltg. BATTERY CORD	V45257-R3010	
Le3	1	Anodenleitung ANODE CORD	V44251-F3013	
	2	Batterie BATTERY	C44153-Z2-C4	
		Schmelzeinsatz FUSE		
	2	0,125 A	D41571-M125-C2	
	2	0,25 A	D41571-M250-C2	

Umrüstsatz S44034-K3010-A701
Option

	1	Zusatzverstärker EXTRA AMPLIFIER	S45035-K5095-A101
	1	Frequenzaussperrung FREQ BLANKING UNIT	S45035-K5102-A701
	1	Frequenzmarke FREQUENCY MARK	S45035-K5104-A701

Relais-Baugruppe S45035-K5094-A701
RELAY SUBASSEMBLY

		Schichtwiderstand LAYER TYPE RESISTOR	
R1	1	22kOhm 5% 0,35W	B51262-A2223-J
R2	1	600 Ohm 5% 0,35W	B51262-A2601-J
		Diode DIODE	
Gr1...4	4	BAW 75	Q62702-A396
		Relais RELAY	
E2,E3; F2,F3,F4; F1...P4; Z1,Z2,Z3; ZE	13	SDS RH 16V	C44303-Z3-C6

Zusatzverstärker S45035-K5095-A101
EXTRA AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	47kOhm 5% 0,35W	B51262-A2473-J
R2	1	470 Ohm 2% 1W	B54383-A471-G1
R3	1	560 Ohm 1% 0,[illegible]W	B51263-A9561-F
R4,15	2	1,5kOhm 5% 0,35W	B51262-A2152-J
R5	1	10kOhm 1% 0,27W	B51263-A9103-F
R6,18	2	51 Ohm 5% 0,35W	B51262-A2510-J
R7,9, 10,16	4	300 Ohm 5% 0,35W	B51262-A2301-J
R8,11	2	6kOhm 1% 0,27W	B51263-A9602-F
R12	1	5,1kOhm 5% 0,35W	B51262-A2512-J
R13	1	1kOhm 1% 0,27W	B51263-A9102-F
R14	1	9,1kOhm 1% 0,27W	B51263-A9912-F
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R17	1	2,2kOhm 20% 0,6W	440061-B8222-M1
		Spule COIL	
L1	1		V45231-C3100
L2	1		V45231-C3227

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1	1	470pF	5%	160V	B31861-A1471-J
C2	1	10pF	20%	160V	B31861-A1100-M
C5	1	2200pF	1%	160V	B31861-A1222-F
C6	1	390pF	1%	160V	B31861-A1391-F
C8	1	4700pF	1%	160V	B31861-A1472-F
C9	1	1200pF	1%	160V	B31861-A1122-F
C10	1	1640pF	1%	160V	B31861-A1162-F400
C12	1	1500pF	20%	160V	B31861-A1152-M
C13	1	47pF	20%	160V	B31861-A1470-M

Tantal-Kondensator
TANTAL CAPACITOR

C7,3, 11,14	4	3,3/uF	20%	15V	B45170-J2335-M

MKL-Kondensator
MKL CAPACITOR

C4	1	1,5/uF	20%	25V	B32110-C3155-M

Diode
DIODE

Gr1...3	3	BAW 75	Q62702-A396

Int. Schaltkreis
INT. CIRCUIT

J1,2	2	TIC 60005	Q67000-A3-S1

Relais
RELAY

N	1	SDS RH 16V	C44303-Z3-C6

Verstärker S45035-K5096-A701
AMPLIFIER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	5,6kOhm	5%	0,15W	B51262-A2562-J
R2	1	1,6kOhm	5%	0,15W	B51262-A2162-J
R4,6, 17,32	4	1,5kOhm	5%	0,15W	B51262-A2152-J
R6	1	4,3kOhm	5%	0,15W	B51262-A2432-J
R7	1	1,3kOhm	1%	0,4W	B51263-A9132-F
R8	1	91kOhm	5%	0,15W	B51262-A2913-J
R16,19 21,23	6	180 Ohm	5%	0,15W	B51262-A2181-J
R13	1	12kOhm	5%	0,15W	B51262-A2123-J
R14	1	7,5kOhm	5%	0,15W	B51262-A2752-J
R15	1	4,75kOhm	1%	0,4W	B54322-A4472-F502
R18,29, 30	3	10kOhm	1%	0,4W	B54322-A4103-F2
R20	1	51 Ohm	5%	0,15W	B51262-A2510-J
R22	1	2,4kOhm	5%	0,15W	B51262-A2242-J
R24	1	22kOhm	1%	0,27W	B51263-A9223-F
R25	1	13kOhm	1%	0,27W	B51263-A9133-F
R26	1	22kOhm	5%	0,15W	B51262-A2223-J
R27	1	8,9kOhm	1%	0,27W	B51263-A9892-F
R31	1	15kOhm	1%	0,27W	B51263-A9153-F
R33	1	39 Ohm	5%	0,15W	B51262-A2390-J
R34	1	3,9kOhm	1%	0,27W	B51263-A9392-F
R35	1	390 Ohm	5%	0,15W	B51262-A2391-J
R36	1	27kOhm	5%	0,35W	B51262-A2273-J
R37,38	2	100kOhm	5%	0,35W	B51262-A2104-J
R11,12	2	1,8kOhm	5%	0,15W	B51262-A2182-J

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R3,5, 28	3	220 Ohm	20%	W40961-B8221-M1
R10	1	22kOhm	20%	W40961-B8223-M1

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1	1	470pF	20%	160V	B31861-A1471-M
C3	1	22pF	20%	160V	B31861-A1220-M
C7	1	120pF	20%	160V	B31861-A1121-M
C16	1	220pF	20%	160V	B31861-A1221-M

MKL-Kondensator
MKL CAPACITOR

C5	1	3,3/uF	20%	25V	B32110-C3335-M
C10	1	10/uF	20%	25V	B32110-C3106-M
C20	1	2,2/uF	20%	25V	B32110-C3225-M

MKM-Kondensator
MKM CAPACITOR

C12,13	2	0,33/uF	5%	160V	B32435-A2334-J
C18	1	0,47/uF	5%	160V	B32435-B2474-J

Keramik-Kondensator
CERAMIC CAPACITOR

C6	1	2700pF	+30-20%	160V	B37632-B5272-R1
C15	1	4700pF	+30-20%	160V	B37632-B5472-R1

Tantal-Kondensator
TANTAL CAPACITOR

C2,4,8, 9,11,14	6	2,2/uF	20%	15V	B45170-J2225-M
C17	1	2,2/uF	20%	10V	B45170-J1225-M
C19	1	15/uF	20%	10V	B45170-J1156-M
C21	1	4,7/uF	20%	10V	B45170-J1475-M
C22	1	33/uF	20%	10V	B45170-J1336-M

Diode
DIODE

Gr1...6	6	BAW 75	Q62702-A396

Transistor
TRANSISTOR

Ta1,2	2	BCY 58 X	Q60203-Y58-K

Int. Schaltkreis
INT. CIRCUIT

J1..3	3	TIC 60005	Q67000-A3-S1

f/U-Wandler S45035-K5097-A701
F/U-CONVERTER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	10kOhm	5%	0,15W	B51262-A2103-J
R2	1	2,2kOhm	5%	0,15W	B51262-A2222-J
R3	1	1,5MOhm	5%	0,33W	B51264-A2155-J
R4,17	2	2,2kOhm	5%	0,15W	B51262-A2222-J
R5,8,9,	5	4,7kOhm	5%	0,15W	B51262-A2472-J
R6,7	2	33kOhm	5%	0,15 W	B51262-A2333-J
R10,19	2	22kOhm	5%	0,15 W	B51262-A2223-J
R11,12	2	2,7kOhm	5%	0,15W	B51262-A2272-J
R13,15	2	4,75kOhm	1%	0,4W	B54322-A4472-F502
R20,25	2	56kOhm	1%	0,27W	B51263-A2563-F
R21	1	910 Ohm	5%	0,15W	B51263-A2911-J
R22	1	20kOhm	1%	0,6W	B51263-A4203-F2
R23	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R26	1	27 Ohm	5%	0,15W	B51262-A2270-J
R27	1	220 Ohm	5%	0,35W	B51262-A2221-J
R28,29	2	680 Ohm	5%	0,35W	B51262-A2681-J
R14,16	2	2,7kOhm	5%	0,15W	B54322-A4472-F502

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R18,24	2	2,2kOhm	20%	W40961-B8222-M1

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1,2	2	6800pF	1%	160V	B31863-B1682-F
C4	1	180pF	20%	160V	B31861-A1181-M

MKK-Kondensator
MKM CAPACITOR

C3	1	0,15/uF	20%	160V	B32435-A2154-M
C7,8	2	0,022/uF	20%	160V	B32435-A2223-M

Tantal-Kondensator
TANTAL CAPACITOR

C5	1	22/uF	20%	10V	B45170-J1226-M
C6	1	6,8/uF	20%	10V	B45170-J1685-M

Diode
DIODE

Gr1..6	6	BAW 75	Q62702-A396
Gr7,8	2	HP 2800	Q62702-A284-F39

Transistor
TRANSISTOR

Ta1..3	3	BCY 58 IX	Q60203-Y58-J

Int. Schaltkreis
INT. CIRCUIT

J1	1	TAA 861	Q67000-A86
J2	1	TAA 861 5mV	Q67000-A86-S2

Logarithmierer S45035-K5098-A731
LOG CONVERTER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1,2, 13,14	4	10kOhm	2%	0,45W	B54322-A4103-G1

R3,11	2	3,9kOhm	5%	0,35W	B51262-A2392-J
R4,12	2	1,5kOhm	5%	0,35W	B51262-A2152-J
R5	1	200 Ohm	2%	0,45W	B54322-A4201-G1
R7	1	2kOhm	5%	0,35W	B51262-A2202-J
R8	1	5,6kOhm	2%	0,45W	B54322-A4562-G
R9	1	3,9kOhm	2%	0,45W	B54322-A4392-G1
R15	1	100kOhm	2%	0,45W	B54322-A4104-G1
R20	1	150kOhm	5%	0,35W	B51262-A2154-J
R18	1	51kOhm	5%	0,35W	B51262-A2513-J
R19	1	1kOhm	5%	0,35W	B51262-A2102-J
R16	1	120kOhm	5%	0,35W	B51262-A2124-J

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R6	1	47 Ohm	20%	W40961-B8470-M1
R17	1	10kOhm	20%	W40961-B8103-M1

Thernewid
THERNEWID THERMISTOR

R10	1	20kOhm	5%	K11d	Q63011-K203-J

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1	1	150pF	5%	160V	B31861-A1151-J
C2	1	1000pF	5%	160V	B31861-A1102-J
C3	1	33pF	5%	160V	B31861-A1330-J
C4	1	47pF	5%	160V	B31861-A1470-J

Transistor
TRANSISTOR

Ts1	1	BFX 15	Q62702-F245

Int. Schaltkreis
INT. CIRCUIT

J1,2	2	TAA 861 5mV	Q67000-A89-S2

Relais
RELAY

Z4	1		C44303-Z3-C3

Batterie-Ladeschaltung S45035-K5099-A701
CHARGER FOR BATTERY

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	2,2kOhm	5%	0,35W	B51262-A2222-J
R2	1	100kOhm	1%	0,45W	B54322-A4104-F2
R3	1	680 Ohm	5%	0,35W	B51262-A2681-J
R4	1	1 Ohm	5%	0,1W	B54415-A2010-J
R6,8	2	10kOhm	5%	0,35W	B51262-A2103-J
R7	1	470 Ohm	5%	0,5W	B51263-A2471-J
R9	1	8,2kOhm	5%	0,35W	B51262-A2822-J

Thernewid
THERNEWID THERMISTOR

R5	1	10 Ohm	K11b	Q63011-K100-M

Tantal-Kondensator
TANTAL CAPACITOR

C1	1	6,8/uF	20%	10V	B45170-J1685-M

Diode
DIODE

Gr1	1	BZX 55 C6 V2	Q62702-Z571
Gr2	1	BAW 75	Q62702-A396
Gr3	1	BZX 55 C12	Q62702-Z684
Gr4	1	SSi B0610	J66047-A1006-A2

Transistor
TRANSISTOR

Ts1	1	2 N 3819	Q62702-C51-F9
Ts2,5	2	BCY 78 IX	Q60203-Y78-J
Ts3	1	BCY 58 VIII	Q60203-Y58-H
Ts4	1	BDY 39	Q62702-D81

E-Cell
E-CELL

	1	E-Cell 560-0002	C44208-Z8-C1

	1	Schalter SWITCH	C42315-A60-A2

Sendeverstarker S45035-K5100-A701
TRANSMITTING AMPLIFIER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1,26	2	16kOhm	1%	0,1W	B51263-A9163-F
R2,27	2	12kOhm	5%	0,15W	B51262-A2123-J
R4,25	2	1kOhm	5%	0,15W	B51262-A2102-J
R5,31	2	4,7kOhm	5%	0,15W	B51262-A2472-J
R29	1	330 Ohm	5%	0,35W	B51262-A2331-J
R7,11, 18,22	4	910 Ohm	5%	0,15W	B51262-A2911-J
R8,19	2	750 Ohm	5%	0,15W	B51262-A2751-J
R9,20	2	1,1kOhm	5%	0,15W	B51262-A2112-J
R10,21	2	2kOhm	5%	0,15W	B51262-A2202-J
R12,23	2	2,4kOhm	5%	0,15W	B51262-A2242-J
R13	1	3kOhm	5%	0,15W	B51262-A2302-J
R14	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R15	1	11kOhm	5%	0,15W	B51262-A2113-J
R16	1	24kOhm	5%	0,15W	B51262-A2243-J
R17	1	47kOhm	5%	0,15W	B51262-A2473-J
R30,36	2	1,5kOhm	5%	0,15W	B51262-A2152-J
R32	1	13kOhm	5%	0,15W	B51262-A2133-J
R34	1	20kOhm	5%	0,15W	B51262-A2203-J
R37,40	2	10kOhm	5%	0,15W	B51262-A2103-J
R38,45	2	100 Ohm	5%	0,15W	B51262-A2101-J
R39	1	270 Ohm	5%	0,15W	B51262-A2271-J
R41,42	2	220 Ohm	5%	0,15W	B51262-A2221-J
R43,44	2	68 Ohm	5%	0,15W	B51262-A2680-J
R46	1	47 Ohm	5%	0,35W	B51262-A2470-J

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R3,28	2	2,2kOhm	20%	W40961-B8222-M1
R33	1	4,7kOhm	20%	W40961-B8472-M1
R35	1	22kOhm	20%	W40961-B8223-M1

MKM-Kondensator
MKM CAPACITOR

C1,2	2	0,1/uF	20%	160V	B32435-A2104-M

Styroflex-Kondensator
STYROFLEX CAPACITOR

C3	1	1500pF	20%	160V	B31861-A1152-M
C4	1	68pF	20%	160V	B31861-A1680-M
C6	1	1000pF	20%	160V	B31861-A1102-M
C7	1	33pF	20%	160V	B31861-A1330-M

Tantal-Kondensator
TANTAL CAPACITOR

C5,8	2	22/uF	20%	15V	B45170-J2226-M
C9	1	220/uF	20%	10V	B45170-A1227-M

Diode
DIODE

Gr1...16	16	BAW 75	Q62702-A396

Transistor
TRANSISTOR

Ts1,4	2	BCY 78 VIII	Q60203-Y78-H
Ts2,3	2	BCY 58 VIII	Q60203-Y58-H

Int. Schaltkreis
INT. CIRCUIT

J1,2	2	TIC 60005	Q67000-A3-S1

Relais
RELAY

E,F	2		C44303-Z3-C6

U/f-Wandler S45035-K5101-A701
U/F CONVERTER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1,3	2	100 Ohm	5%	0,15W	B51262-A2101-J
R2	1	15kOhm	5%	0,15W	B51262-A2153-J
R4,5	2	5,6kOhm	5%	0,15W	B51262-A2562-J
R6,7	2	560 Ohm	5%	0,15W	B51262-A2561-J
R8,9, 10,11, 17	5	10kOhm	5%	0,15W	B51262-A2103-J
R12	1	100kOhm	5%	0,15W	B51262-A2104-J
R14	1	470kOhm	5%	0,2W	B51372-A4474-J
R15	1	38,3kOhm	1%	0,4W	B54322-A4383-F3C2
R16	1	40,2kOhm	1%	0,4W	B54322-A4403-F202
R18	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R19,28	2	51 Ohm	5%	0,15W	B51262-A2510-J
R20	1	20kOhm	5%	0,15W	B51262-A2203-J
R23,24	2	33 Ohm	5%	0,15W	B51262-A2330-J
R22	1	10kOhm	5%	0,35W	B51262-A2103-J
R25	1	18kOhm	5%	0,15W	B51262-A2183-J
R32	1	9,1kOhm	5%	0,35W	B51262-A2912-J

R27	1	330 Ohm	5%	0,15W	B51262-A2331-J
R29	1	680 Ohm	5%	0,15W	B51262-A2681-J
R30,31, 33	3	220kOhm	5%	0,2W	B51372-A4224-J
R34,35	2	4,7kOhm	5%	0,15W	B51262-A2472-J
R36,37	2	9,1kOhm	5%	0,15W	B51262-A2912-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR			
R13	1	100kOhm	20%		W40961-B8104-M1
R26	1	4,7kOhm	20%		W40961-B8472-M1
R38	1	5kOhm			V26120-Z10-V9
		Tantal-Kondensator TANTAL CAPACITOR			
C1,2, 12,13, 16	5	3,3/uF	20%	15V	B45170-J2335-M
C18,19	2	1,5/uF	20%	25V	B45170-J2155-M
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C4,6	2	300pF	20%	160V	B31861-A1101-M
C7,10	2	1000pF	1%	160V	B31861-A1102-F
C8	1	1000pF	20%	160V	B31861-A1102-M
C9	1	33pF	20%	160V	B31861-A1330-M
C11	1	120pF	20%	160V	B31861-A1121-M
C14,15	2	22pF	20%	160V	B31861-A1220-M
C17	1	56pF	20%	160V	B31861-A1560-M
C21	1	2200pF	20%	160V	B31861-A1222-M
		MKL-Kondensator MKL CAPACITOR			
C20	1	4,7/uF	20%	25V	B32110-C3475-M
		Diode DIODE			
Gr1,2,5, 6,10, 11	6	BAW 75			Q62702-A396
Gr3,4	2	AAZ 15			Q60101-Z15-F1
		Ref. Element REF. ELEMENT			
Gr7,8	2	1 N 825			Q62702-Z598-F11
		Transistor TRANSISTOR			
Ts1,10, 11	3	BCY 78 VIII			Q60203-Y78-H
Ts2,3,6, 7,8,9	6	BCY 58 X			Q60203-Y58-K
Ts4,5	2	2 N 3819			Q62702-C51-F9
		Int. Schaltkreis INT. CIRCUIT			
J1	1	TOA 8709			Q67000-A71-F11
J2	1	TIC 60005			Q67000-A3-S1

Frequenzaussperrung S45035-K5102-A701
FREQUENCY BLANKING UNIT

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1,4	2	2,2kOhm	5%	0,35W	B51262-A2222-J
R3,6	2	120 Ohm	5%	0,35W	B51262-A2121-J
R7	1	15kOhm	5%	0,35W	B51262-A2153-J
R8	1	3,9kOhm	5%	0,35W	B51262-A2392-J
R10	1	680 Ohm	5%	0,35W	B51262-A2681-J
R11	1	22kOhm	5%	0,35W	B51262-A2223-J
R12,13, 21	3	10kOhm	5%	0,35W	B51262-A2103-J
R14,15, 23	3	10kOhm	1%	0,27W	B51263-A9103-F
R16,17	2	180 Ohm	5%	0,35W	B51262-A2181-J
R18,19	2	200kOhm	1%	0,27W	B51264-A9204-F
R24	1	9,1kOhm	5%	0,35W	B51262-A2912-J
R25	1	4,7kOhm	5%	0,35W	B51262-A2472-J
R27	1	33 Ohm	5%	0,35W	B51262-A2330-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR			
R2,5, 26	3	2,2kOhm	20%		W40961-B8222-M1
R9	1	4,7kOhm	20%		W40961-B8472-M1
R20	1	22kOhm	20%		W40961-B8223-M1
R22	1	470 Ohm	20%		W40961-B8471-M1
		Tantal-Kondensator TANTAL CAPACITOR			
C1,2	2	3,3/uF	20%	15V	B45170-J2335-M
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C3	1	47pF	20%	160V	B31861-A1470-M
		Diode DIODE			
Gr1...4	4	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1	1	BCY 78 VIII			Q60203-Y78-H
Ts2	1	BCY 58 X			Q60203-Y58-K
		Int. Schaltkreis INT. CIRCUIT			
J1,2	2	TIC 60005			Q67000-A3-S1
J3	1	TAA 861			Q67000-A89

Wobbelgenerator S45035-K5103-A701
SWEEP GENERATOR

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	750 Ohm	5%	0,15W	B51262-A2751-J
R2	1	6,8kOhm	1%	0,1W	B51263-A9682-F
R3	1	1,6kOhm	5%	0,15W	B51262-A2162-J
R4	1	220 Ohm	5%	0,15W	B51262-A2221-J
R5	1	68kOhm	5%	0,15W	B51262-A2683-J
R6,25,28	2	33kOhm	5%	0,15W	B51262-A2333-J
R7	1	8,2kOhm	5%	0,15W	B51262-A2822-J
R9	1	17kOhm	1%	0,1W	B51262-A9173-F
R10	1	29kOhm	1%	0,1W	B51263-A9293-F
R11	1	68kOhm	1%	0,1W	B51263-A9683-F
R12	1	20kOhm	1%	0,1W	B51262-A9203-F
R13	1	1,5kOhm	5%	0,15W	B51262-A2152-J
R14	1	75kOhm	2%	0,45W	B54322-A4753-G1
R15	1	5,1kOhm	5%	0,15W	B51262-A2512-J
R18	1	12kOhm	5%	0,15W	B51262-A2123-J
R19	1	5,6kOhm	5%	0,15W	B51262-A2562-J
R20	1	220 Ohm	5%	0,15W	B51262-A2221-J
R21	1	6,2kOhm	5%	0,15W	B51262-A2622-J
R23	1	4,7kOhm	5%	0,15W	B51262-A2472-J
R24,26	2	10kOhm	5%	0,15W	B51262-A2103-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR			
R8	1	220kOhm	20%		W40961-B8224-M1
R17	1	47kOhm	20%		W40961-B8473-M1
R22	1	47 Ohm	20%		W40961-B8470-M1
R27	1	10kOhm	20%		W40961-B8103-M1
		Thernewid THERNEWID THERMISTOR			
t16	1	5kOhm	5%		Q63011-K502-J
		MKL-Kondensator MKL CAPACITOR			
C1	1	10/uF	10%	25V	B32110-C3106-K
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C2	1	4700pF	20%	160V	B31863-B1472-M
C3	1	220pF	20%	160V	B31861-A1221-M
C4	1	100pF	20%	160V	B31861-A1101-M
C5,7	2	47pF	20%	160V	B31861-A1470-M
C6	1	150pF	20%	160V	B31861-A1151-M
		Keramik-Kondensator CERAMIC CAPACITOR			
C8	1	1000pF	20%	500V	B37602-A5102-M
		Diode DIODE			
Gr1,2	2	BZX 55 C6 V2			Q62702-Z571
Gr3	1	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1	1	BCY 58 X			Q60203-Y58-K
Ts2	1	BFY 81			Q62702-F165
Ts3,4	2	BCY 58 IX			Q60203-Y58-J
		Int. Schaltkreis INT. CIRCUIT			
J1,2	2	TIC 60005			Q67000-A3-S1
J3,4	2	TAA 861 5mV			Q67000-A89-S2
		Relais RELAY			
A,B	2	SDS RH 16V			C44303-Z3-C6

Frequenzmarke S45035-K5104-A701
FREQUENCY MARK

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	33kOhm	2%	0,4W	B54322-A4333-G1
R2	1	12kOhm	5%	0,15W	B51262-A2123-J
R3	1	100kOhm	2%	0,4W	B54322-A4104-G1
R4	1	12kOhm	2%	0,4W	B54322-A4123-G1
R5	1	470kOhm	5%	0,33W	B51264-A2474-J
R6	1	2,2kOhm	2%	0,4W	B54322-A4222-G1
R7	1	22kOhm	2%	0,4W	B54322-A4223-G1
R8...11	4	10MOhm	10%	50mV	B53264-A106-K
R12,18, 21,22	4	22kOhm	5%	0,15W	B51262-A2223-J
R13,15	2	240kOhm	5%	0,25W	B51263-A2244-J
R14,16	2	33kOhm	5%	0,15W	B51262-A2333-J
R17	1	15kOhm	5%	0,15W	B51262-A2153-J
R19	1	2,2kOhm	5%	0,15W	B51262-A2222-J
R20	1	39kOhm	5%	0,15W	B51262-A2393-J
R23,24	2	560 Ohm	5%	0,35W	B51262-A2561-J
		MKL-Kondensator MKL CAPACITOR			
C1	1	2,2 µF	20%	25V	B32110-C3225-M
C6	1	1 µF	20%	63V	B32110-E9105-M
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C2...5	4	100pF	20%	160V	B31861-A1101-M
C10	1	180pF	20%	160V	B31861-A1181-M
		MKM-Kondensator MKM CAPACITOR			
C8,9	2	0,027 µF	20%	160V	B32435-A2273-M
		Tantal-Kondensator TANTAL CAPACITOR			
C11,12	2	100 µF	20%	20V	B45170-J3107-M
		Transistor TRANSISTOR			
Ts1,7, 8,10	4	BCY 58 VIII			Q60203-Y58-H
Ts2...5	4	2 N 3819			Q62702-C51-P9
Ts6,9, 11	3	BCY 78 VIII			Q60203-Y78-H

Regelteil S45035-K5105-A701
REGULATING SECTION

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1,4	2	1,8kOhm	5%	0,35W	B51262-A2182-J
R2,3, 7,8, 11,12	6	10kOhm	5%	0,35W	B51262-A2103-J
R5,6	2	510 Ohm	5%	0,35W	B51262-A2511-J
R9,10	2	680 Ohm	5%	0,35W	B51262-A2681-J
R13,16	2	2,7 Ohm	5%	0,25W	B54412-A2020-J700
R14,15	2	100 Ohm	5%	0,35W	B51262-A2101-J
R17,18	2	390 Ohm	5%	0,35W	B51262-A2391-J
R19,24	2	1,82kOhm	1%	0,45W	B54322-A4182-F202
R21,22	2	5,11kOhm	1%	0,45W	B54322-A4512-F102
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR			
R20,23	2	1kOhm	20%		W40961-B8102-M1
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C1,2	2	1800 pF	20%	160V	B31861-A1182-M
		Tantal-Kondensator TANTAL CAPACITOR			
C3,4	2	33 µF	20%	15V	B45170-J2336-M
		Ref. Element REF. ELEMENT			
Gr1,2	2	1 N 825			Q62702-Z598
		Diode DIODE			
Gr3...8	6	BAW 75			Q62702-A396
		Transistor TRANSISTOR			
Ts1,10	2	BCY 78 IX			Q60203-Y78-J
Ts2,9	2	BCY 58 X			Q60203-Y58-K
Ts3,6	2	BCY 78 VIII			Q60203-Y78-H
Ts4,5	2	BCY 58 VIII			Q60203-Y58-H
Ts7	1	2 N 2218 A			Q62702-S29
Ts8	1	2 N 2904 A			Q62702-P91

Hochspannungswandler S45035-K5106-A701
HIGH-VOLTAGE CONVERTER

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	1,8kOhm	5%	0,25W	B51263-A2182-J
R2,8	2	82kOhm	2%	0,4W	B54322-A4823-G1
R3	1	10kOhm	2%	0,4W	B54322-A4103-G1
R4	1	560 Ohm	2%	0,4W	B54322-A4561-G1
R5	2	3,3kOhm	2%	0,4W	B54322-A4332-G1
R7	1	3,3kOhm	5%	0,35W	B51262-A2332-J
R9	1	12kOhm	2%	0,4W	B54322-A4123-G1
R11	1	15kOhm	2%	0,4W	B54322-A4153-G1
R12	1	2,7MOhm	5%	0,33W	B51264-A2275-J
R13	1	1,2MOhm	5%	0,33W	B51264-A2125-J
R14,17	2	100MOhm	10%	50mW	B53264-A107-K
R16	1	6,8MOhm	5%	1W	B51266-A2685-J
R21	1	47 Ohm	5%	0,35W	B51262-A2470-J
R22	1	10 Ohm	5%	0,35W	B51262-A2100-J
R6	1	3kOhm	2%	0,4W	B54322-A4302-G1
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR			
R10	1	1kOhm	30%	0,8W	V44215-Z3008-A7
R15	1	1MOhm	30%	0,8W	V44215-Z3008-A16
R19,20	2	220kOhm	30%	0,8W	V44215-Z3008-A14
R18	1	100kOhm	30%	0,8W	V44215-Z3008-A13
		Spule COIL			
L1	1	68 µH	0,2A		C44330-Z5-C14
		Übertrager TRANSFORMER			
Ü1	1				V44230-N3029-A
		Tantal-Kondensator TANTAL CAPACITOR			
C1	1	47 µF	20%	35V	B45170-J4476-M
C3	1	1 µF	20%	20V	B45170-J3105-M
		Styroflex-Kondensator STYROFLEX CAPACITOR			
C2	1	2,7nF	20%	160V	B31861-A1272-M
		Elko ELECTROLYTIC CAPACITOR			
C4	1	4,7 µF	+50-10%	160V	B43588-A1475-T
C17	1	100 µF	+50-10%	40V	B41588-A7107-T
		MKH-Kondensator MKH CAPACITOR			
C5...10, 12,14,15	9	5nF	20%	1,6kV	B32237-A1502-M
C13	1	0,025 µF	20%	1kV	B32237-A253-S
C11,16	2	0,1 µF	20%	160V	B32435-A2104-M
		Diode DIODE			
Gr1	1	DX 6393			Q62702-A110-P7
Gr2	1	BAW 75			Q62702-A396
Gr3	1	BZX 55 C5 V6			Q62702-Z570
Gr5...14	10	10 D 10			Q62702-Y200-P76
Gr4	1	10 D 4			Q62702-Y199-P76
Gr15,16	2	ZD 56			V42292-Z3-A31
		Transistor TRANSISTOR			
Ts1,2	2	BFX 34			Q60206-X34
Ts3,5	2	2 N 3440			Q62702-D5
Ts4	1	BCY 58 VIII			Q60203-Y58-H

Sperrwandler S45035-K5107-A701
DC/DC CONVERTER

		Schichtwiderstand LAYER-TYPE RESISTOR			
R1	1	2,2kOhm	5%	0,35W	B51262-A2222-J
R2	1	1,1kOhm	5%	0,35W	B51262-A2112-J
R3	1	2kOhm	2%	0,45W	B54322-A4202-G1
R4	1	6,8kOhm	2%	0,45W	B54322-A4682-G1
R15,21	2	91kOhm	2%	0,45W	B54322-A4913-G1
R16	1	3kOhm	2%	0,45W	B54322-A4302-G1
R17	1	56kOhm	2%	0,45W	B54322-A4563-G1
R18	1	5,6kOhm	2%	0,45W	B54322-A4562-G1

R20	1	7,5kOhm	2%	0,45W	B54322-A4752-G1
R22	1	10kOhm	2%	0,45W	B54322-A4103-G1
R24	1	16kOhm	2%	0,45W	B54322-A4163-G1
R25	1	3,3kOhm	2%	0,45W	B54322-A4332-G1
R26	1	82kOhm	5%	0,35W	B51262-A2823-J
R27	1	56kOhm	5%	0,35W	B51262-A2563-J
R6	1	100 Ohm	5%	0,35W	B51262-A2101-J
R7	1	27kOhm	5%	0,35W	B51262-A2273-J
R28	1	27 Ohm	5%	0,35W	B51262-A2270-J
R40	1	12kOhm	5%	0,35W	B51262-A2123-J
R32	1	2,2kOhm	5%	0,35W	B51262-A2222-J
R33	1	22kOhm	5%	0,35W	B51262-A2223-J
R37,42	1	220kOhm	5%	0,35W	B51262-A2224-J
R31,39	2	100kOhm	5%	0,35W	B51262-A2104-J
R30,34, 35,36, 38	5	68kOhm	5%	0,35W	B51262-A2683-J
R41	1	470 Ohm	5%	0,35W	B51262-A2471-J

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R5, 23	2	1kOhm	20%		W40961-A8102-M
R19	1	2,2kOhm	20%		W40961-A8222-M

Spule
COIL

L1	1		V44231-C3248
L2,3	2		V44231-F3113

Übertrager
TRANSFORMER

Ü1	1		V44230-K3023-A

Tantal-Kondensator
TANTAL CAPACITOR

C2,3	2	140/uF	20%	60V	B45265-A7147-J
C5	1	10/uF	20%	15V	B45170-J2106-M
C7,8	2	180/uF	20%	25V	B45265-A4187-M
C11	1	6,8/uF	20%	6V	B45170-A685-M
C12	1	0,68/uF	20%	75V	B45170-J7684-M
C13	1	3,3/uF	20%	10V	B45170-J1335-M

Elko
ELECTROLYTIC CAPACITOR

C9,10	2	220/uF	+50-10%	B41588-J5227-T

Styroflex-Kondensator
STYROFLEX CAPACITOR

C4	1	390pF	20%	160V	B31861-A1391-M
C6	1	1800pF	10%	160V	B31862-A1182-K

MKH-Kondensator
MKH CAPACITOR

C14	1	0,1/uF	20%	160V	B32435-A2104-M

Diode
DIODE

Gr1	1	BZX 55 C6 V2	Q62702-Z571
Gr2,3,5	3	ZX 6393	Q62702-A110-P7
Gr4,10, 11	3	BAW 75	Q62702-A396
Gr6,7	2	1 N 4935	Q62702-Y190
Gr8,9	2	ZD 20	V42292-Z3-A20
Gr12	1	BZX 55 C27 V	Q62702-Z847
Gr13	1	BZX 55 C7 V5	Q62702-Z573
Gr14	1	BZX C11	Q62702-Z683
Gr15,16	2	BAW 75	Q62702-A396

Transistor
TRANSISTOR

Ts1	1	2 N 3819	Q62702-C51-P9
Ts2,3	2	BCY 79 IX	Q60203-Y79-J
Ts4	1	BFX 34	Q60203-X34
Ts5	1	2 N 2219 A	Q62702-S3-A1
Ts6	1	BDY 58	Q62702-D9C-P10
Ts7,8	2	2 N 3440	Q62702-D5
Ts9	1	BCY 58 VIII	Q60203-Y58-H
Ts10	1	BCY 59 IX	Q60203-Y59-J
Ts11,12, 13	3	BCY 78 IX	Q60203-Y78-J

Sicherung
FUSE

S1	1	0,8 A	D41571-T800-B2
S2	1	0,4 A	D41571-T400-B2

Meßfeld S45035-K5110-A201
MEAS FIELD

S7	1	Pegelschalter (1dB-Schritte) LEVEL SWITCH (1dB-STEPS)	S45035-K5110-S1
S2	1	Z-Schalter Z-SWITCH	S45035-K5110-S2
S4	1	Pegelschalter (5dB-Schritte) LEVEL SWITCH (5dB-STEPS)	S45035-K5110-S3
S6	1	Pegelschalter (10dB-Schritte) LEVEL SWITCH (10dB-STEPS)	S45035-K5110-S4
	1	Teiler DIVIDER	S45035-K5110-S5
S9	1	Wobbelschalter SWEEP SWITCH	S45035-K5110-S6

Drehschalter
ROTARY SWITCH

S1	1	C40315-M302-B1
S2	1	C40315-B304-B1
S3	1	V42265-A136-B71
S5	1	C40315-M163-J226
S10	1	Kippschalter TOGGLE SWITCH C44315-Z10-C2
	1	Abdeckkappe SWITCH COVER (für S10) (FOR S10) C44315-Z10-C3
	1	Drucktaste PUSHBUTTON C42315-A11-A2
	1	Schauzeichen VISUAL INDICATOR M1401-B-A1
	1	Buchseneinheit JACK UNIT V42255-B10-A22

Schichtwiderstand
LAYER-TYPE RESISTOR

R30	1	600 Ohm	0,5%	1W	B54415-A9601-D
R31	1	900 Ohm	0,5%	1W	B54415-A9901-D
R32	1	4kOhm	5%	1W	B54415-A2402-J
R42	1	1,5 Ohm	5%	0,25W	B54412-A2010-J500
R33	1	910 Ohm	5%	0,35W	B51262-A2911-J
R34	1	10kOhm	5%	0,35W	B51262-A2103-J

Schichtdrehwiderstand
LAYER-TYPE VAR RESISTOR

R43	1	22 Ohm	20%		W40961-B8220-M
P3	1	1MOhm	30%	lin	W40101-C8105-N1
P4	1	1kOhm	30%	lin	W40101-C8102-N1
P1	1	500 Ohm	30%	lin	W40101-C8501-N1
P2	1	200kOhm	30%	lin	W40101-C8204-N1
P8	1	10kOhm			C44408-Z11-C16
P5	1	50 Ohm			C44408-Z18-C1

Übertrager
TRANSFORMER

Ü1	1	V44221-E3042-A
Ü2	1	V45221-D3031

Tantal-Kondensator
TANTAL CAPACITOR

C1	1	220/uF	20%	10V
C4	1	6,8/uF	20%	10V

MKL-Kondensator
MKL CAPACITOR

C2,3	2	2,2/uF	20%	100V	B32110-D225-M

Diode
DIODE

Gr1...6	6	BAW 75	Q62702-A396

Pegelschalter (10dB-Schritte) S45035-K5110-S1
LEVEL SWITCH (10dB-STEPS)

S7	1	Schalter SWITCH		C40315-M2161-J328
		Schichtwiderstand LAYER-TYPE RESISTOR		
R6	1	10,87kOhm	0,5%	B51264-A9103-D670
R7	1	9,7kOhm	0,5%	B51264-A9972-D
R8	1	8,64kOhm	0,5%	B51264-A9862-D400
R9	1	7,7kOhm	0,5%	B51264-A9772-D
R10	1	6,86kOhm	0,5%	B51264-A9682-D600
R11	1	6,23kOhm	0,5%	B51264-A9622-D300
R12	1	5,33kOhm	0,5%	B51264-A9532-D300
R13	1	4,68kOhm	0,5%	B51264-A9462-D600
R14	1	4,51kOhm	0,5%	B51264-A9452-D100
R15	1	3,85kOhm	0,5%	B51264-A9382-D500
R16	1	31,62kOhm	0,5%	B51264-A9313-D620

Z-Schalter S45035-K5110-S2
Z-SWITCH

S8	1	Schalter SWITCH		C40315-M2162-J331
		Schichtwiderstand LAYER-TYPE RESISTOR		
R17,28	2	15,6kOhm	1% 0,2W	B51263-A9153-F600
R18,27	2	31,2kOhm	1% 0,2W	B51263-A9313-F200
R19,26	2	78kOhm	1% 0,2W	B51263-A9783-F
R20,25	2	156kOhm	1% 0,3W	B51264-A9154-F600
R21,24	2	450 Ohm	0,5% 0,5W	B54414-A9451-D
R22,23	2	300 Ohm	0,5% 0,5W	B54414-A9301-D

Pegelschalter (5dB-Schritte) S45035-K5110-S3
LEVEL SWITCH (5dB-STEPS)

S4	1	Schalter SWITCH		C40315-M2161-J331
		Schichtwiderstand LAYER-TYPE RESISTOR		
R33	1	20,57kOhm	0,5%	B51264-A9203-D570
R34	1	11,57kOhm	0,5%	B51264-A9113-D570
R35	1	6,5kOhm	0,5%	B51264-A9652-D
R36	1	3,66kOhm	0,5%	B51264-A9362-D600
R37	1	2,057kOhm	0,5%	B51264-A9202-D570
R38	1	1,157kOhm	0,5%	B51264-A9112-D570
R39	1	650 Ohm	0,5%	B51264-A9651-D
R40	1	366 Ohm	0,5%	B51264-A9361-D600
R41	1	470 Ohm	0,5%	B51264-A9471-D
		Diode DIODE		
Gr1...3	3	BAW 75		Q62702-A396

Pegelschalter (10dB-Schritte) S45035-K5110-S4
LEVEL SWITCH (10dB-STEPS)

S6	1	Schalter SWITCH		C40315-M1301-B6
		Schichtwiderstand LAYER-TYPE RESISTOR		
R1	1	684 Ohm	0,5% 0,33W	B54413-A9681-D400
R2	1	216 Ohm	0,5% 0,33W	B54413-A9211-D600
R3	1	68,4 Ohm	0,5% 0,33W	B54413-A9682-D400
R4	1	21,6 Ohm	0,5% 0,33W	B54413-A9216-D600
R5	1	10 Ohm	0,5% 0,33W	B54413-A9100-D

Teiler S45035-K5110-S5
DIVIDER

		Schichtwiderstand LAYER-TYPE RESISTOR		
R1	1	133 Ohm	1% 0,6W	B54322-A4133-F2
R3	1	287 Ohm	1% 0,6W	B54322-A4287-F702
R4	1	220 Ohm	1% 0,6W	B54322-A4221-F2
R5	1	10kOhm	1% 0,6W	B54322-A4103-F2
R6	1	3,01kOhm	1% 0,6W	B54322-A4302-F102
R9,10	2	1,5kOhm	1% 0,6W	B54322-A4152-F2
R11	1	4,7kOhm	5% 0,35W	B51262-A2472-J
R12	1	51 Ohm	5% 0,35W	B51262-A2510-J
R1	1	240 Ohm	2% 0,6W	B54322-A4241-G1
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR		
R2,8	2	470 Ohm	20%	W40961-B6471-M*
		Styroflex-Kondensator STYROFLEX CAPACITOR		
C1	1	47pF	20% 160V	B31861-A1470-M
		Int. Schaltkreis INT. CIRCUIT		
J1	1	TAA 861		Q67000-A89

Wobbelschalter S45035-K5110-S6
SWEEP SWITCH

S9	1	Schalter SWITCH		C40315-M1302-B6
		Schichtwiderstand LAYER-TYPE RESISTOR		
R1,3	2	5,6kOhm	5% 0,35W	B51262-A2562-J
R2	1	7,5kOhm	5% 0,35W	B51262-A2752-J
		Diode DIODE		
Gr1,2,3	3	BAW 75		Q62702-A396
Gr4	1	BZX 55 C6 V2		Q62700-Z57

Netzteil S45035-K5111-A701
POWER SUPPLY UNIT

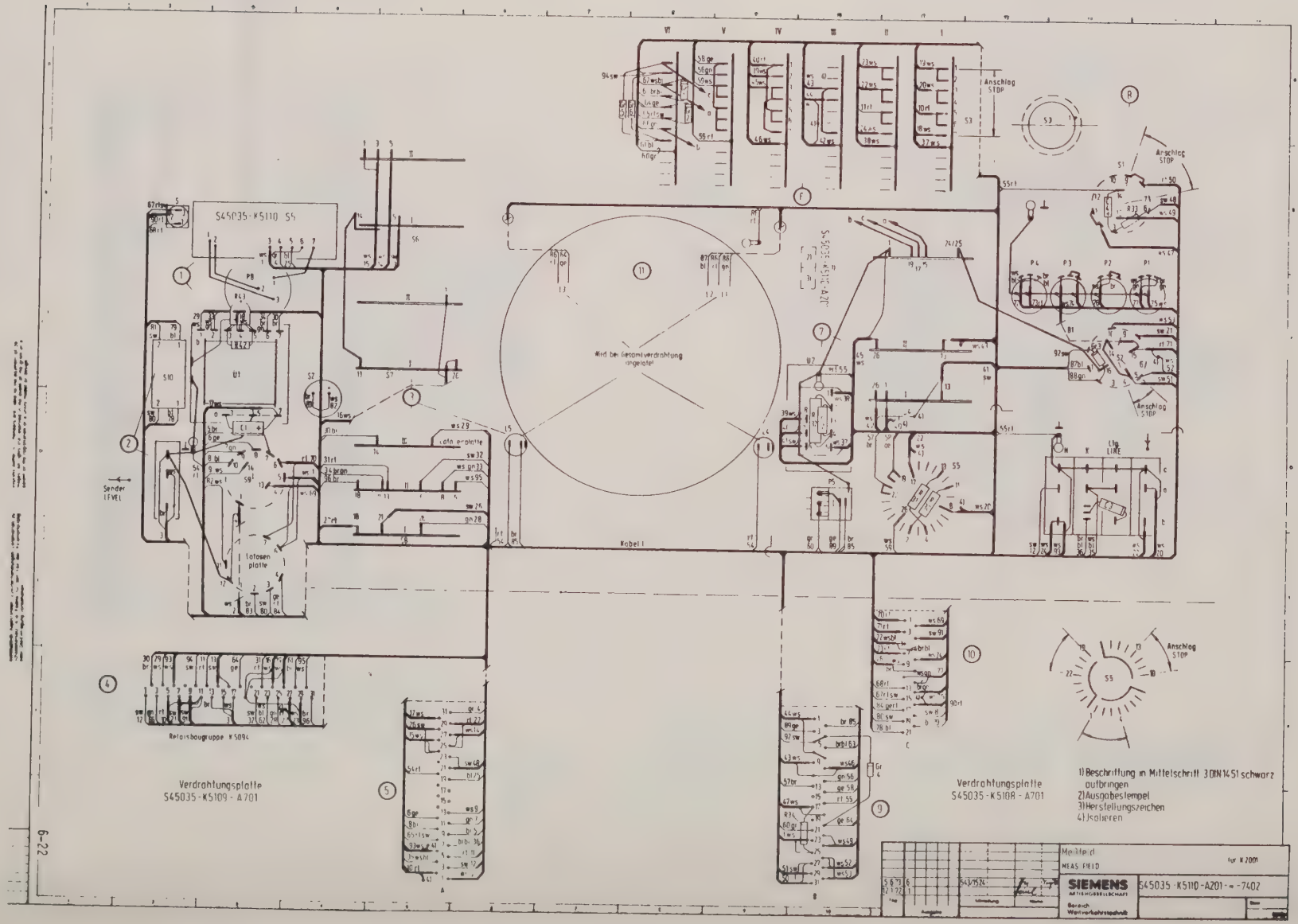
	1	Relais-Baugruppe 2 RELAY SUBASSEMBLY 2	S45035-K5111-S1
		Elko ELECTROLYTIC CAPACITOR	
C1	1	4700 µF +50-10% 40V	B41711-A7478-T
Tr	1	Netztrafo TRANSFORMER	V45221-P3012
Gr	1	Gleichrichter RECTIFIER	V23212-B1310
	1	Netzeinbaustecker VOLTAGE SELECTOR	V45257-M3003
		Sicherung FUSE	
	*	0,25A	D41571-M250-C2

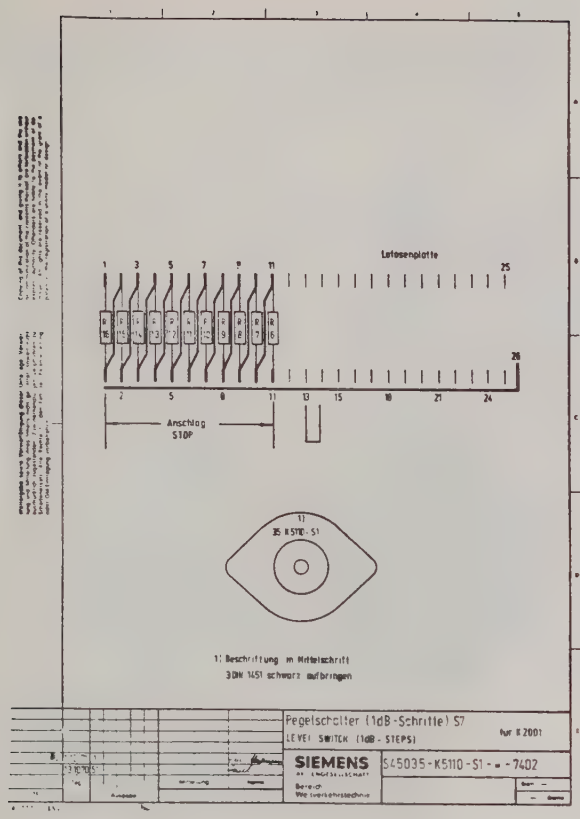
Relais-Baugruppe 2 S45035-K5111-S1
RELAY SUBASSEMBLY 2

		Schichtwiderstand LAYER-TYPE RESISTOR		
R1	*	820 Ohm	5% 1W	B54415-A2821-J
		Diode DIODE		
Gr1	*	BAW 75		Q62702-A396
C	*	Relais RELAY		C44303-D3-C3

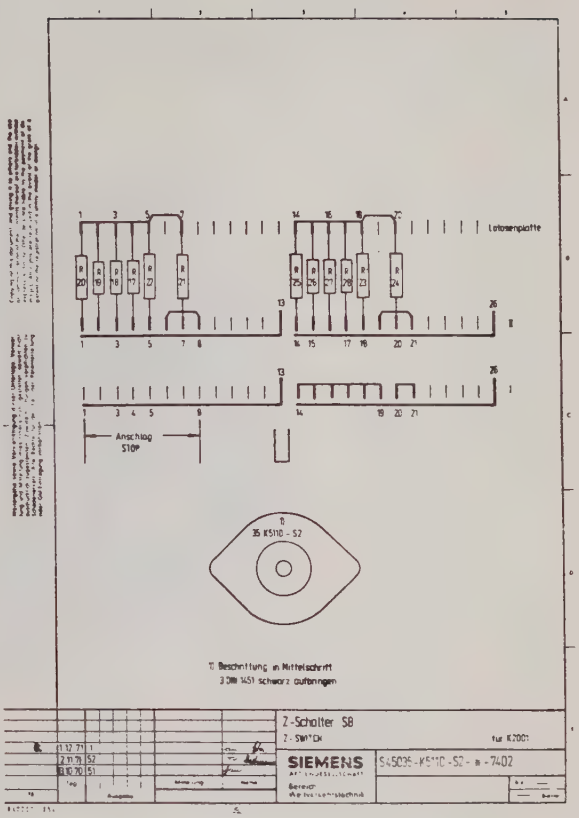
K5108-U1
Bauteileseite
5
Querverdrahtung 1
CROSS WIRING
SIEMENS
S45035-K5108-A701-*-7402

S45035-K5109-U1
Formdraht
Bauteileseite
5
Querverdrahtung 2
CROSS WIRING
SIEMENS AG
S45035-K5109-A701-*-7402
6-21

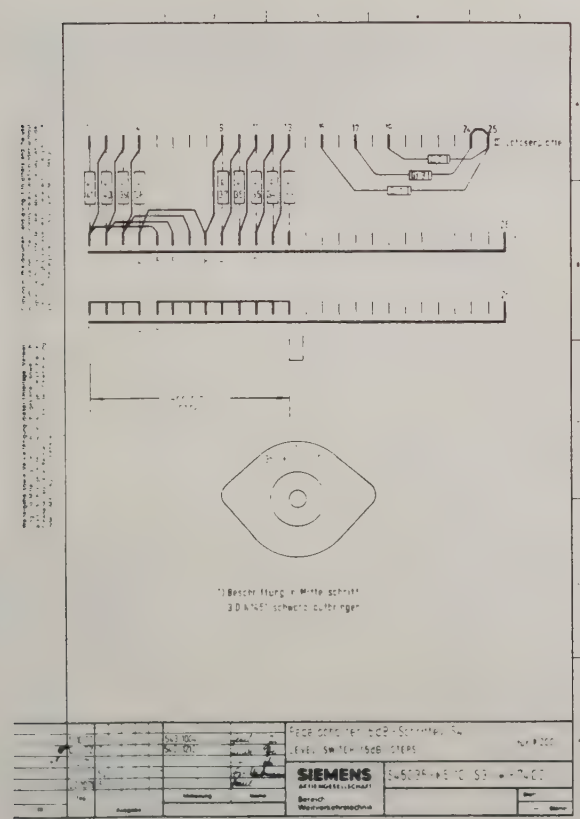

S45035-K5110 S5
S5
S2
S1
Anschlag STOP
Wird bei Gesamtverdrahtung angelotet
Kabel 1
Lötösenplatte
Sender LEVEL
Relaisbaugruppe K5094
Verdrahtungsplatte S45035-K5109-A701
Verdrahtungsplatte S45035-K5108-A701
1) Beschriftung in Mittelschrift 3 DIN 1451 schwarz aufbringen
2) Ausgabestempel
3) Herstellungszeichen
4) Isolieren
Maßstab
MEAS. FIELD
für K 2001
SIEMENS
AKTIENGESELLSCHAFT
Bereich Wartevorkehrssysteme
S45035-K5110-A201-...-7402



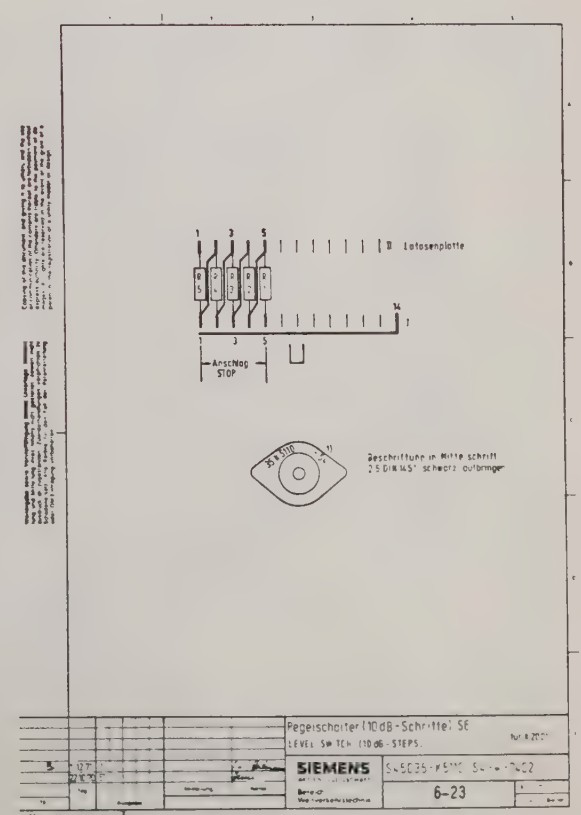
Pegelschalter (1dB-Schritte) S7
LEVEL SWITCH (1dB-STEPS)
für K2001
SIEMENS
S45035-K5110-S1-■-7402



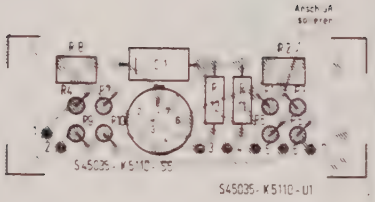
Z-Schalter S8
Z-SWITCH
für K2001
SIEMENS
S45035-K5110-S2-■-7402



SIEMENS

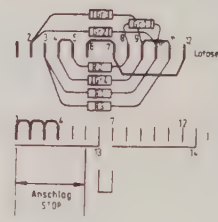


Pegelschalter (10dB-Schritte) S6
LEVEL SWITCH (10dB-STEPS)
für K2001
SIEMENS
S45035-K5110-S6-■-7402



Frequenzeinstellung
FREQUENCY CONTROL
für K 2001

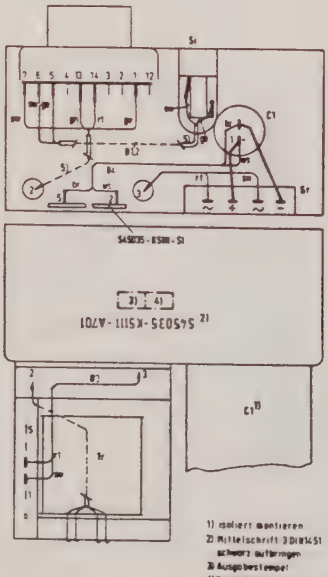
SIEMENS
S45035 - K5110 - S5 - * - 7402



1) Beschriftung in Mittelschrift 2,5 DIN 1451 schwarz aufbringen

Wobbelschalter S5
SWEEP SWITCH

SIEMENS
S45035 - K5110 - S5 - * - 7402

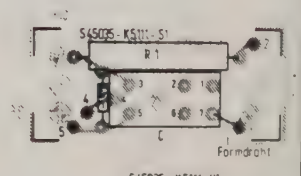


1) isoliert spulieren
2) Mittelschrift 3 DIN 1451 schwarz aufbringen
3) Ausgabestempel
4) Herstellungszeichen
5) mit Vinylschlauch überziehen

Satz Formdraht
(S45035 - K5111 - 11)
B1, B2 L-SF SL 8/4,7 (Schnittstreifen) Art.Nr. 8542
B3 TV 2 x 0,5/80 - 8 rt/sw Fa. Doduco
B4 ws/br

Netzteil
POWER SUPPLY UNIT
für K 2001

SIEMENS
S45035 - K5111 - A701 - * - 7402



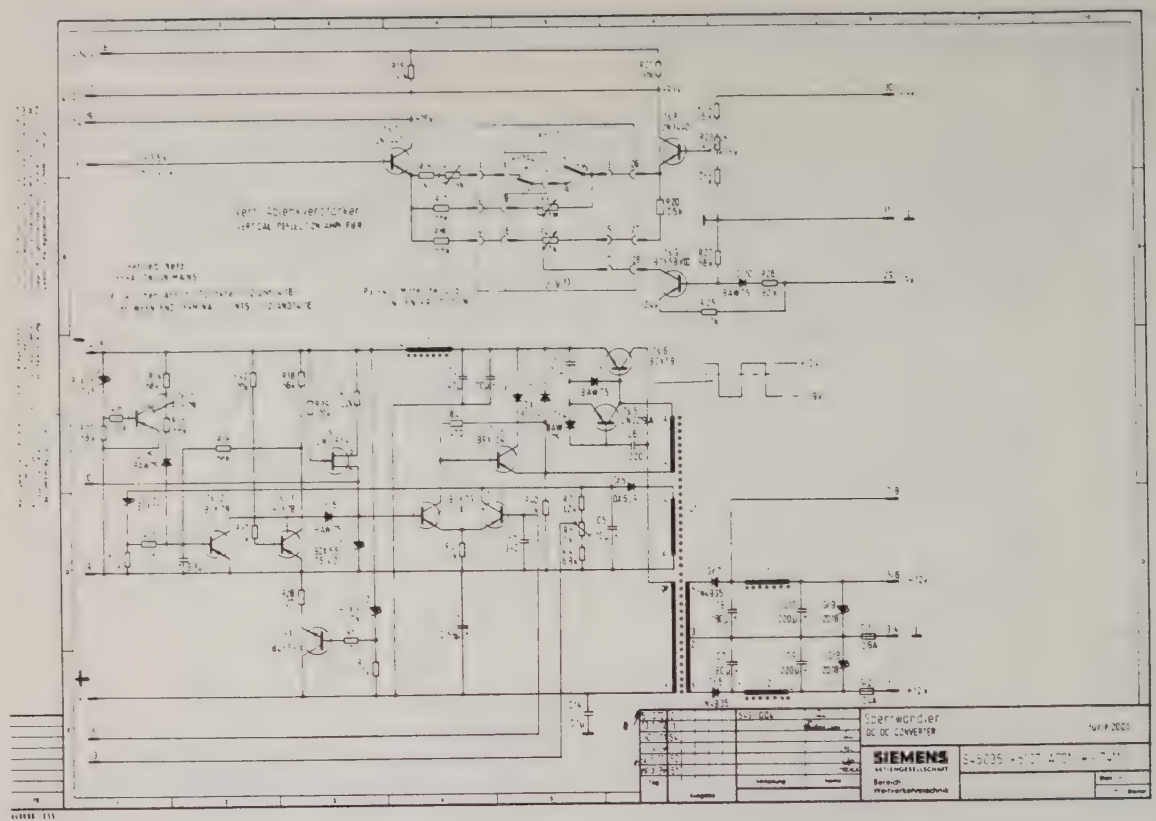
Max. Bauteilehöhe 15mm

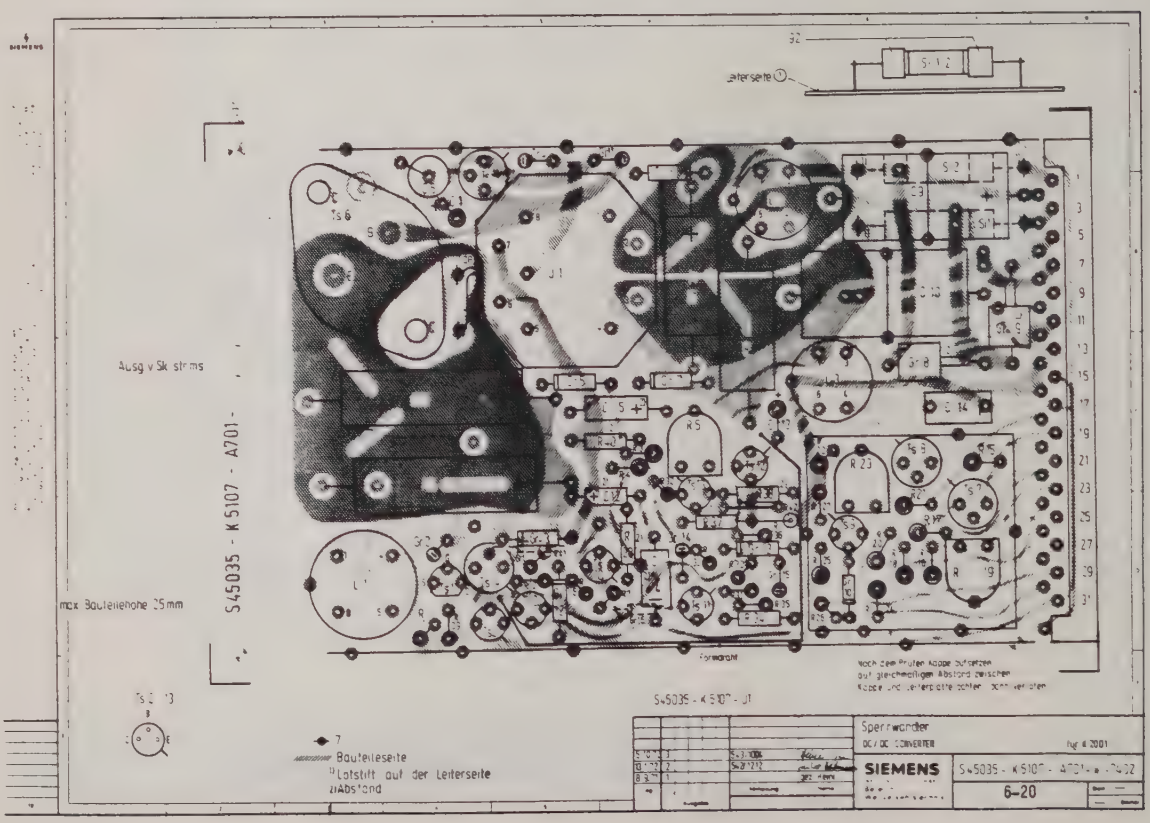
S45035 - K5111 - U1

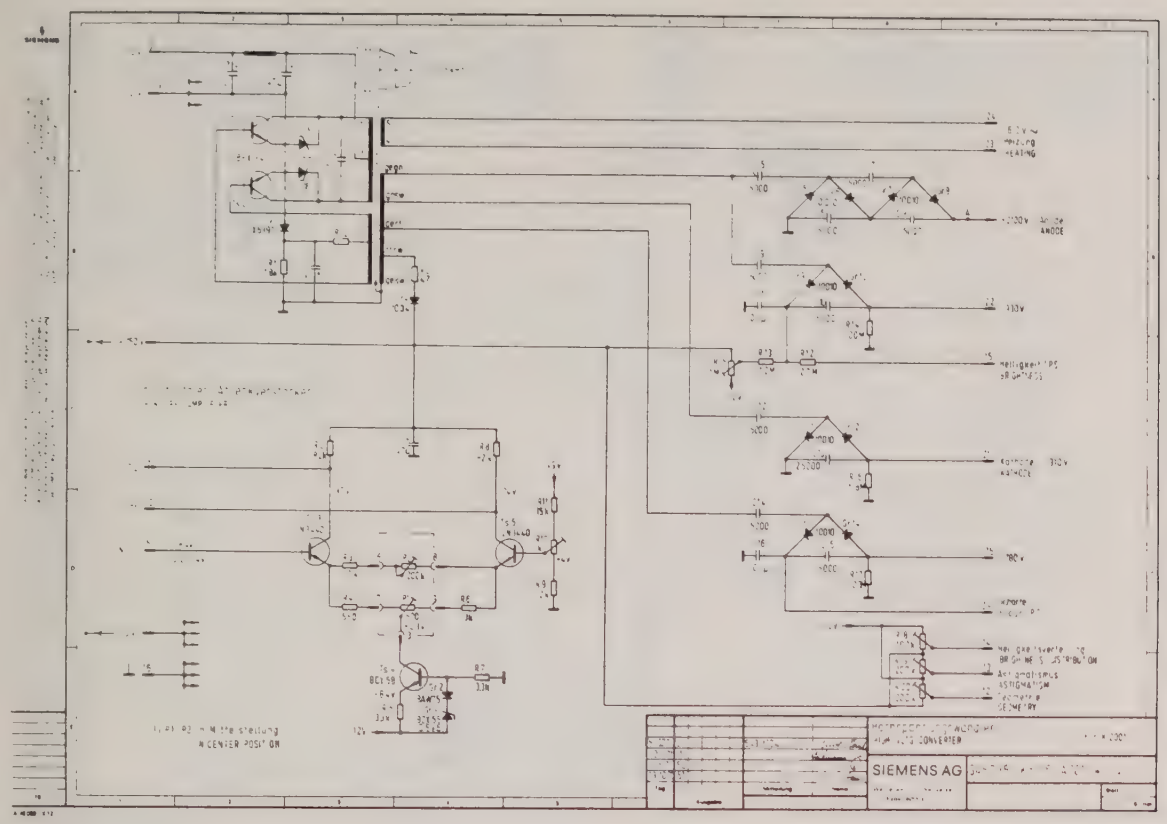
Relais - Baugruppe 2
RELAY SUBASSEMBLY 2
für K 2001

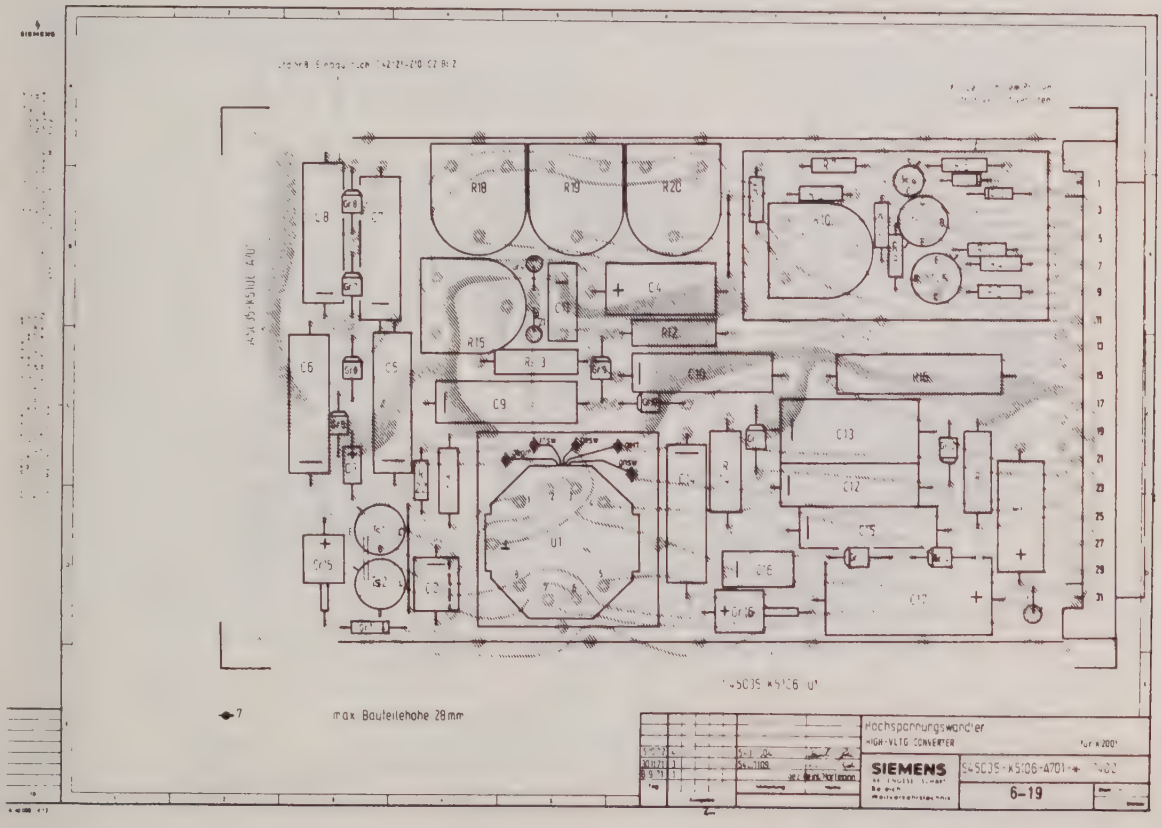
SIEMENS
S45035 - K5111 - S1 - * - 7402

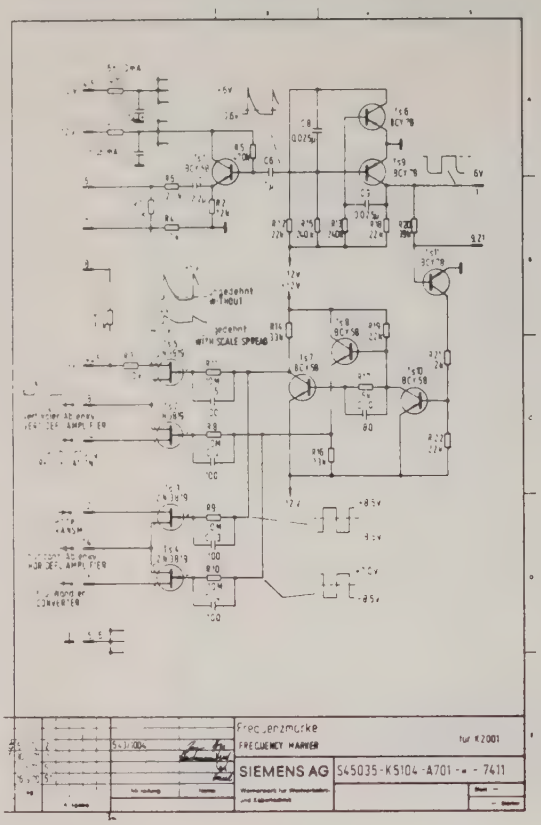
6-24

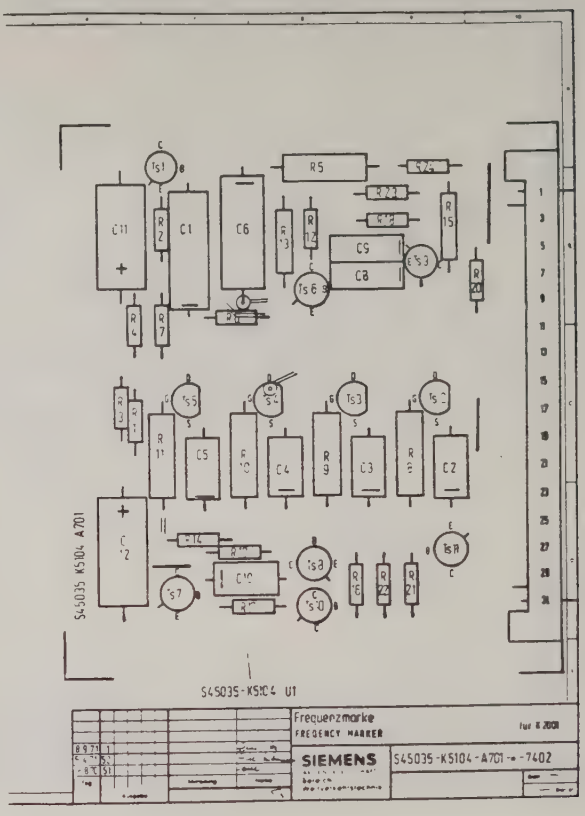

Sperrwandler
DC/DC CONVERTER
SIEMENS
S45035 - K5107 - A701

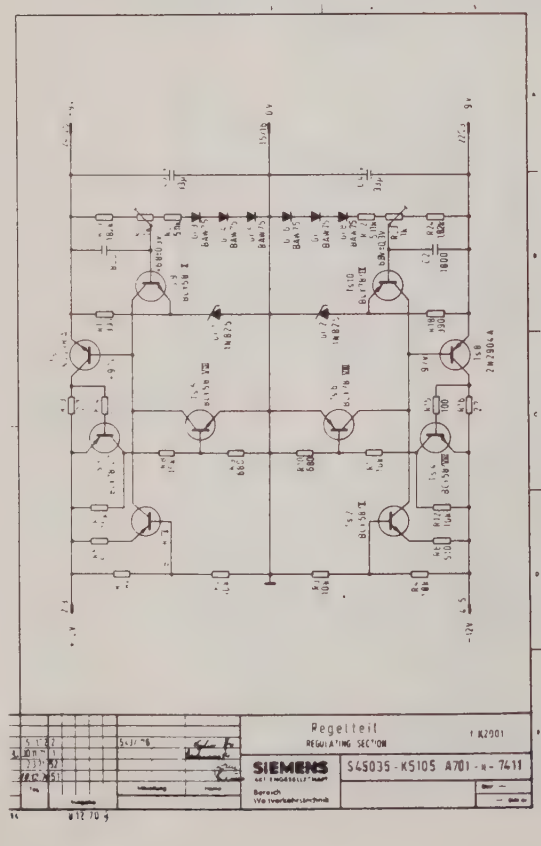

Leiterseite
S45035 - K5107 - A701
max Bauteilehöhe 25mm
Bauteilseite
Lötstift auf der Leiterseite
Sperrwandler
DC/DC CONVERTER
SIEMENS
S45035 - K5107 - A701
6-20

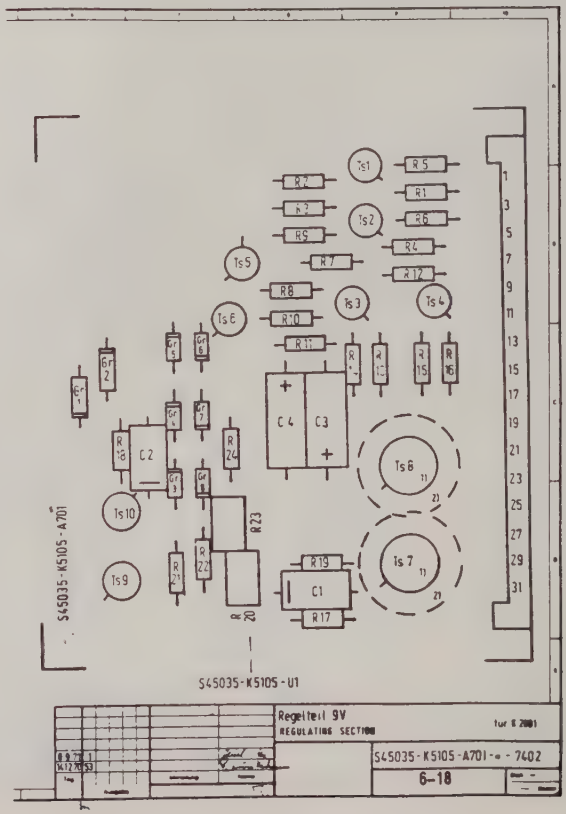

SIEMENS AG

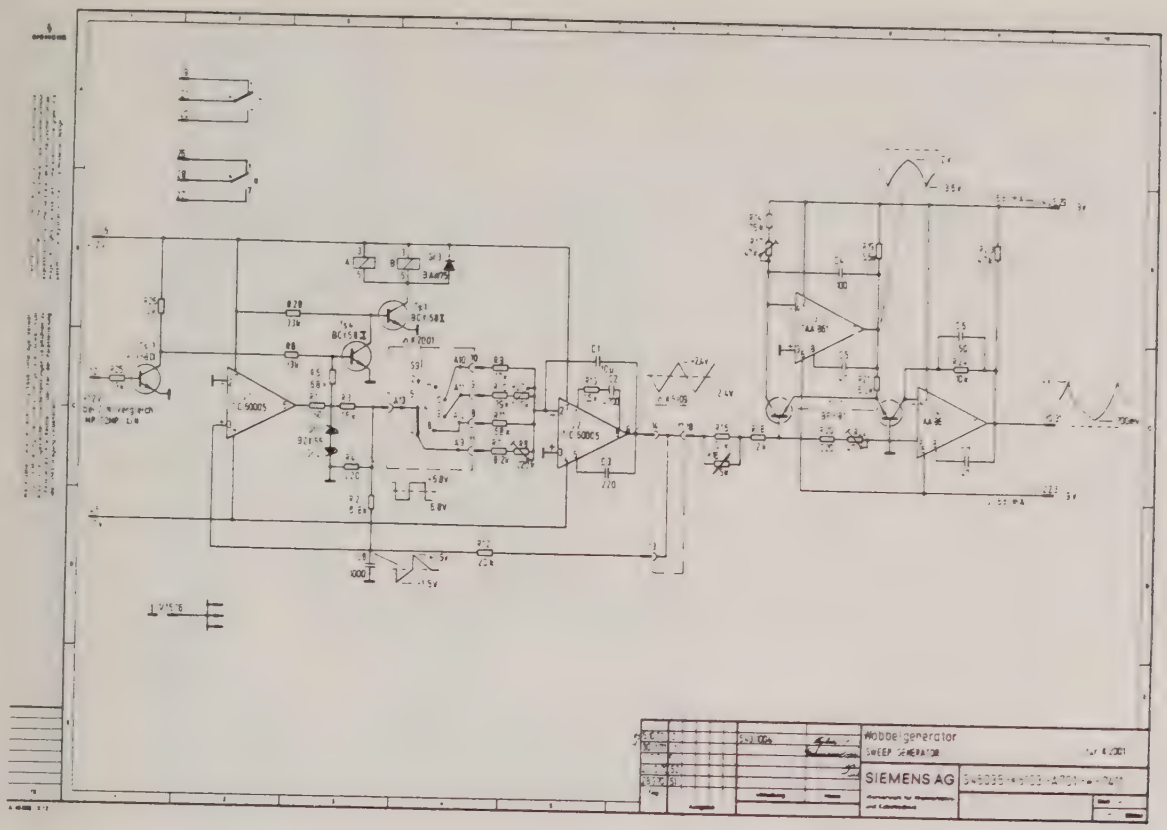

R18
R19
R20
C8
C6
C5
C9
R15
C4
C13
C12
C15
C16
C17
U1
max. Bauteilehöhe 28mm
Hochspannungswandler
HIGH-VLTG CONVERTER
SIEMENS
6-19

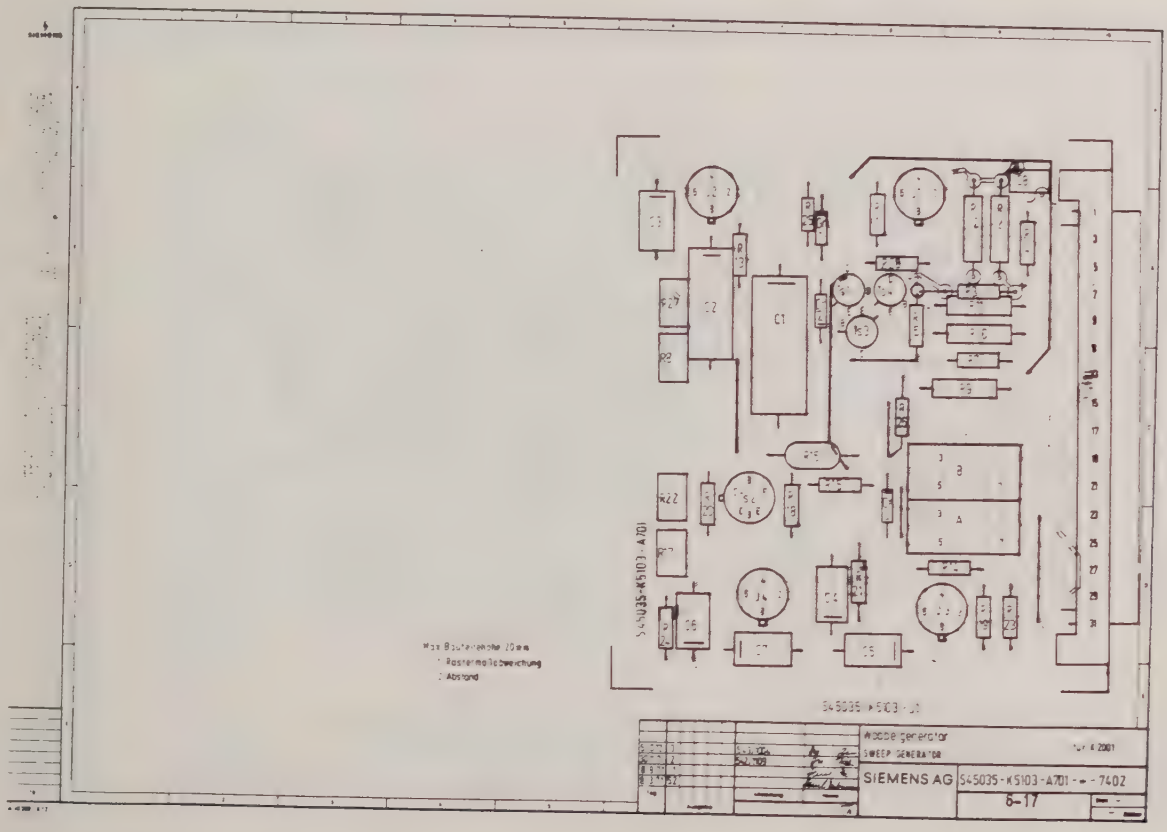

Frequenzmarke
FREQUENCY MARKER
für K2001
SIEMENS AG
S45035-K5104-A701-=-7411

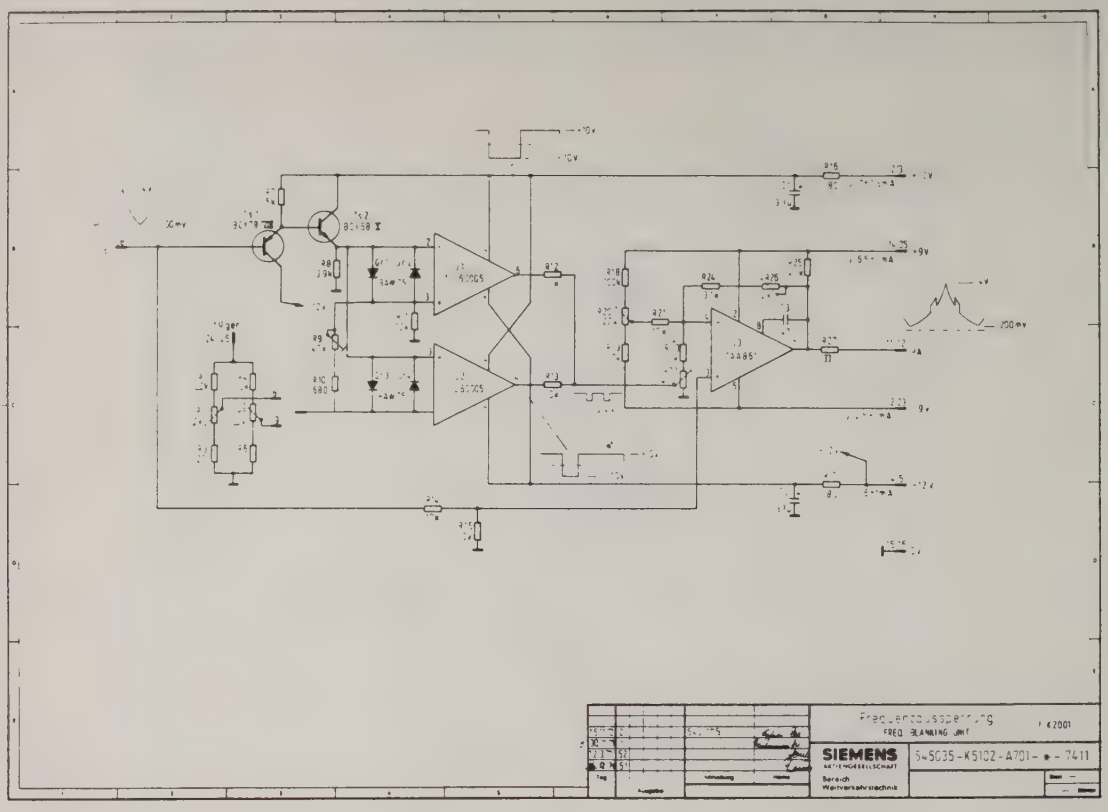

S45035-K5104 A701
S45035-K5104 U1
Frequenzmarke
FREQUENCY MARKER
für K 2001
SIEMENS
S45035-K5104-A701-=-7402


Regelteil
REGULATING SECTION
für K2001
SIEMENS
S45035-K5105 A701-=-7411

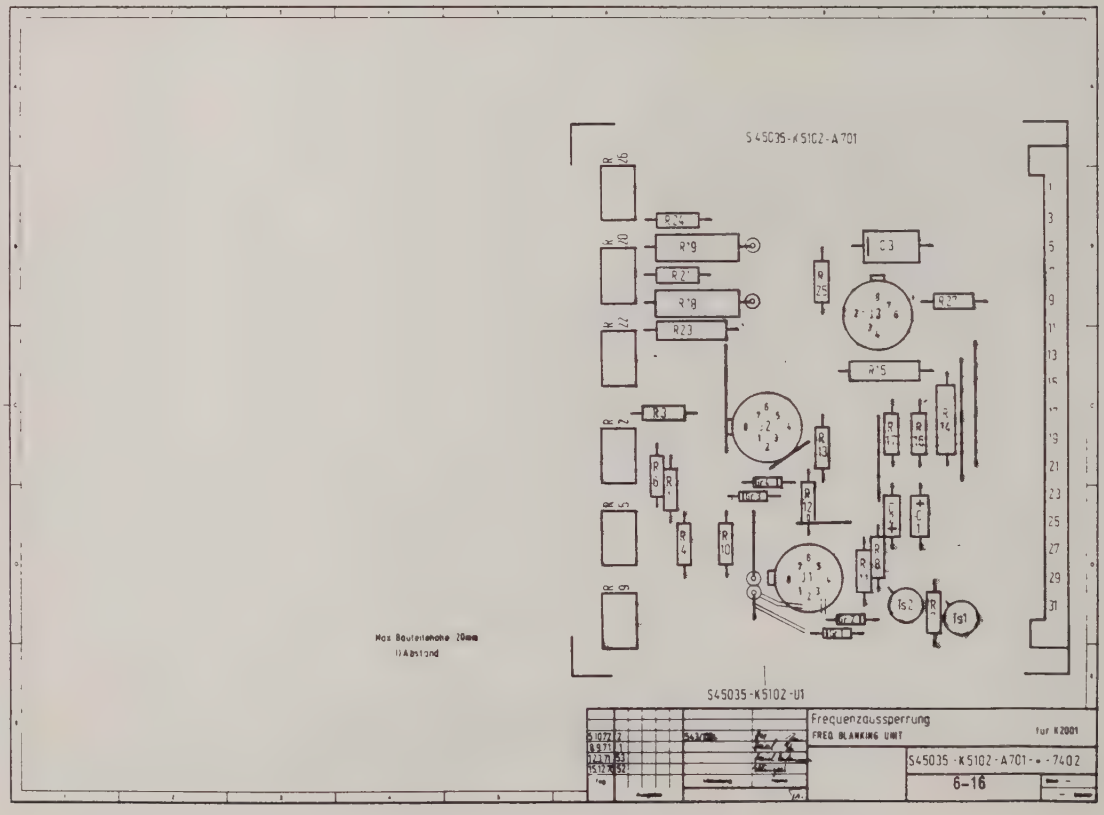

S45035-K5105-A701
S45035-K5105-U1
Regelteil 9V
REGULATING SECTION
für K 2001
S45035-K5105-A701-=-7402
6-18


Wobbelgenerator
SWEEP GENERATOR
SIEMENS AG
S45035-K5103-A701-
7401


S45035-K5103-A701
Wobbelgenerator
SWEEP GENERATOR
SIEMENS AG
S45035-K5103-A701-
7402
8-17

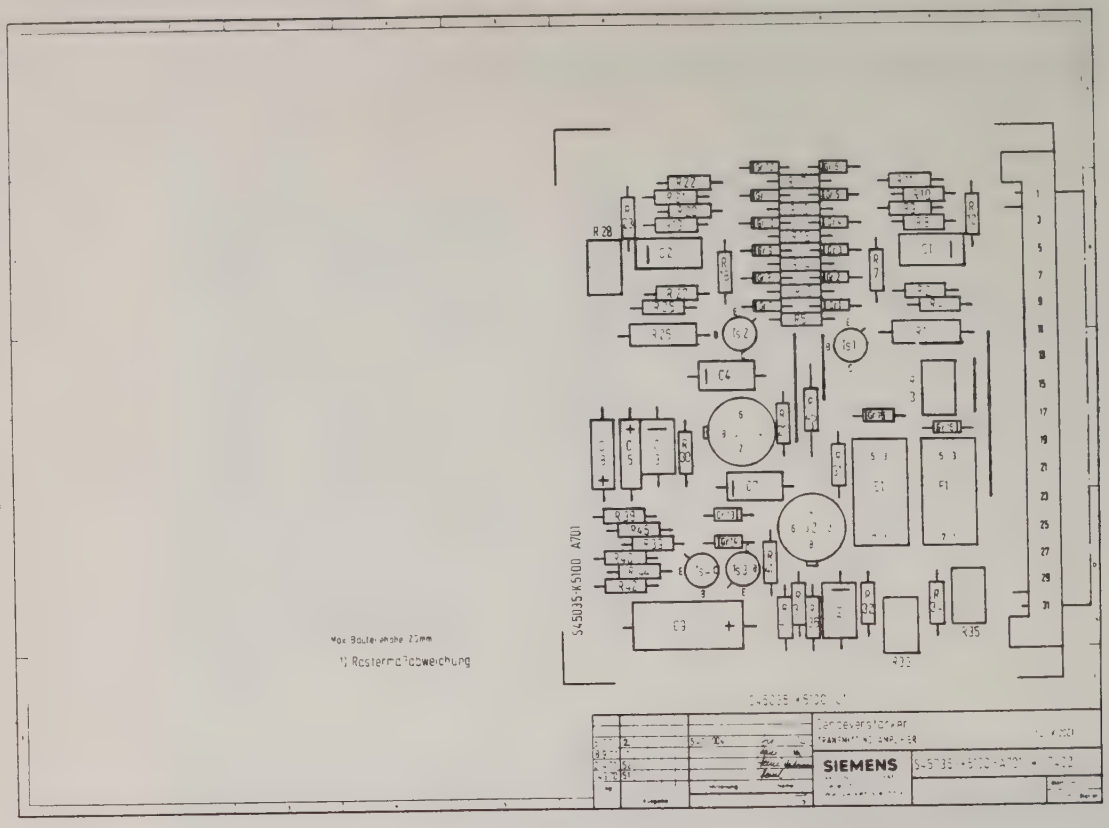


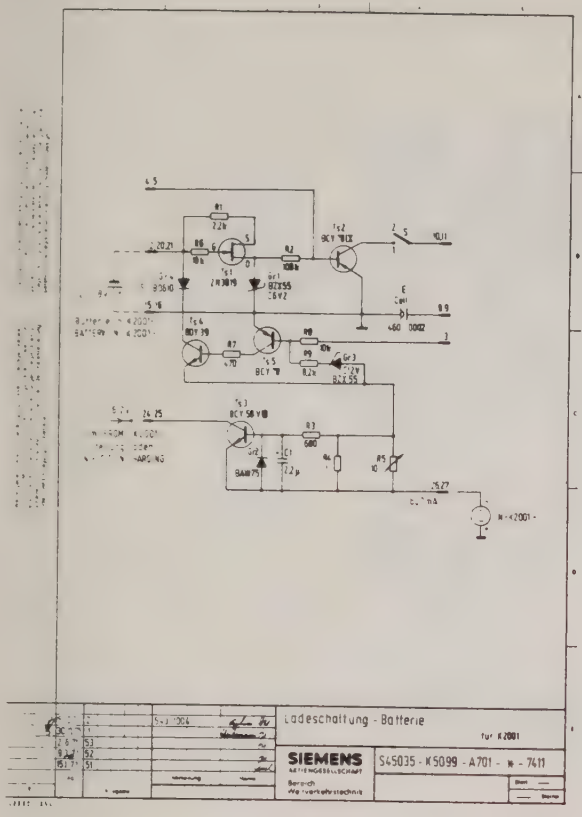
Frequenzaussperrung
FREQ. BLANKING UNIT
für K2001
SIEMENS AKTIENGESELLSCHAFT
Bereich Wehrsprechtechnik
S45035-K5102-A701-*-7411



Frequenzaussperrung
FREQ. BLANKING UNIT
für K2001
S45035-K5102-A701-*-7402
6-16

6-15
SIEMENS AG
U/I-Wandler
S45035-K5101 A701 #-7411


SIEMENS
6-14

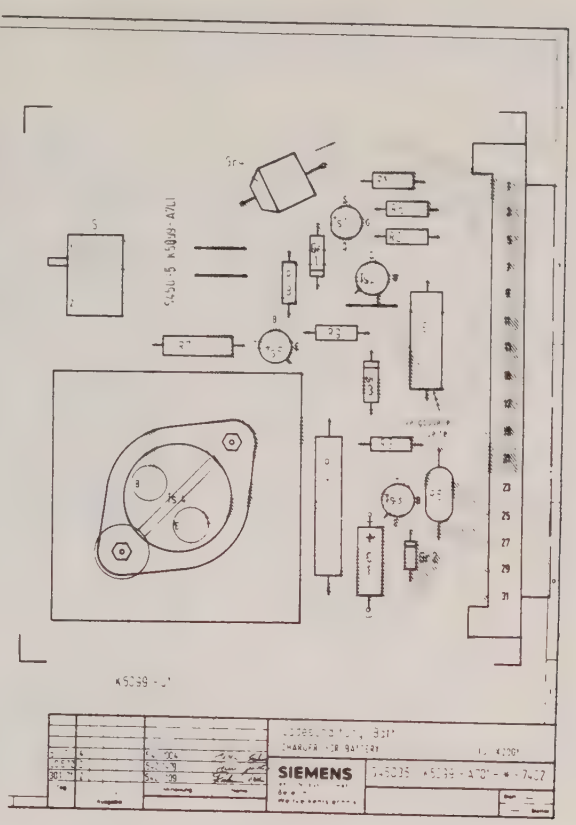


Ladeschaltung - Batterie

für K2001

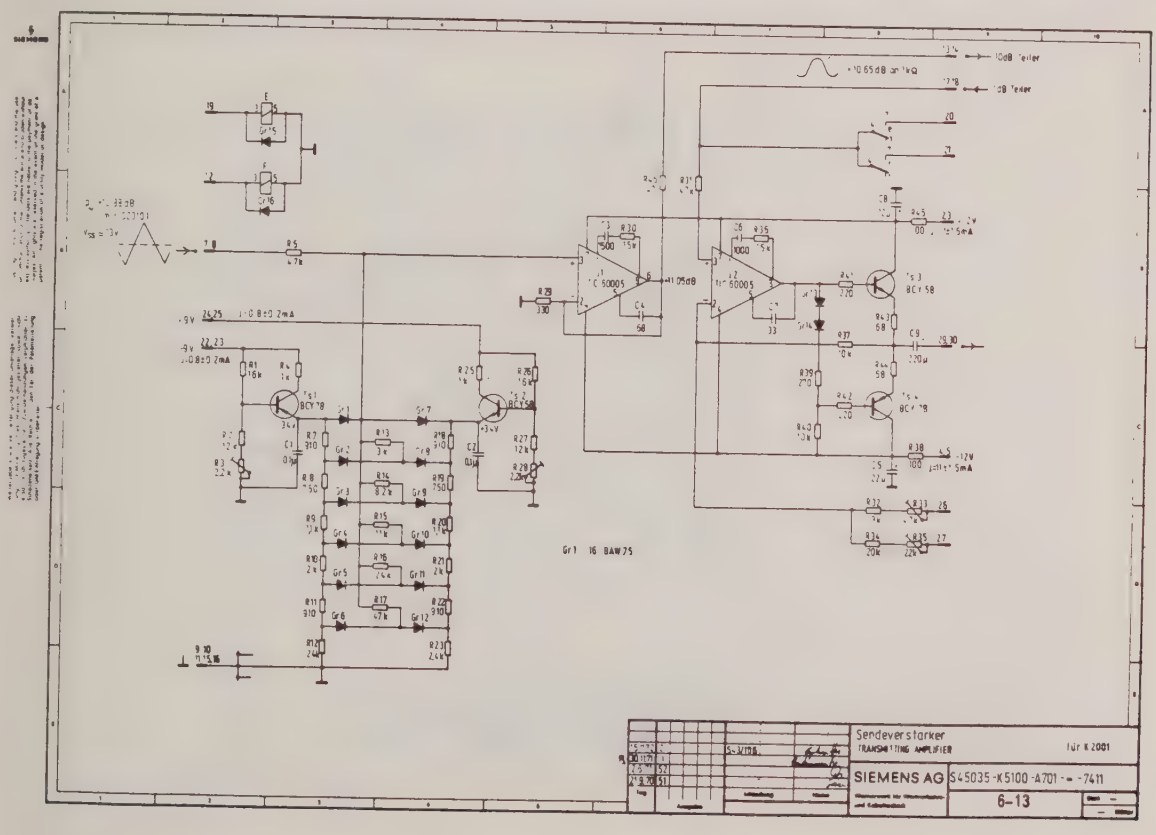
SIEMENS

S45035 - K5099 - A701 - ■ - 7411



SIEMENS

S45035 - K5099 - A701 - ■ - 7427



Sendeverstärker

TRANSMITTING AMPLIFIER

für K2001

SIEMENS AG

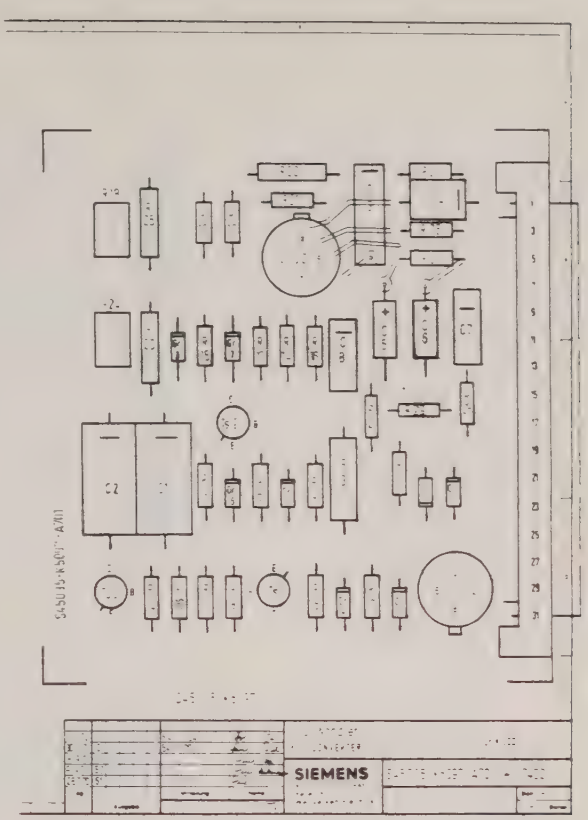
S45035-K5100-A701-■-7411

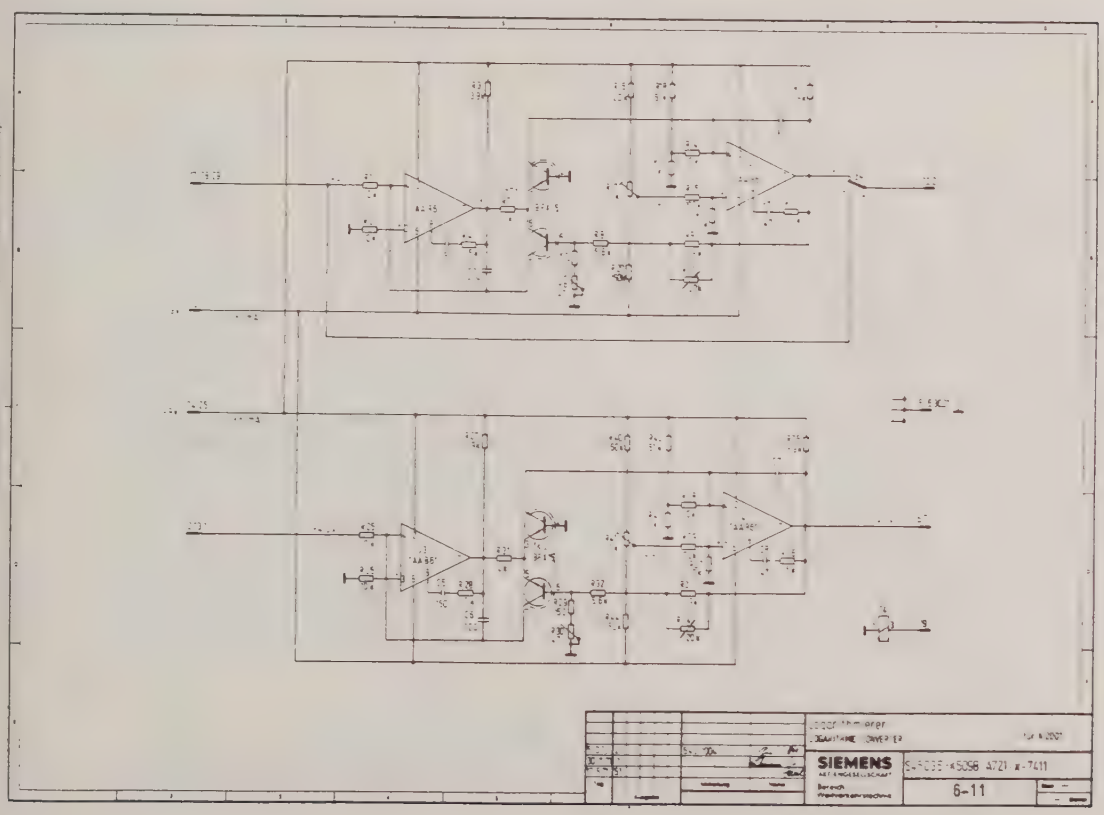
6-13

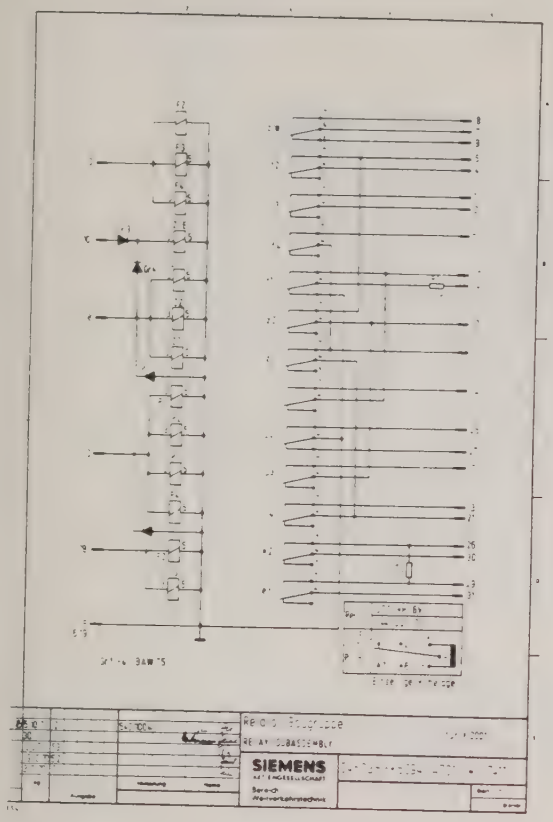
SIEMENS
LOGARITHMIC CONVERTER
S45035-K5098-A721-⊕-7402
S45035-K5098-UZ

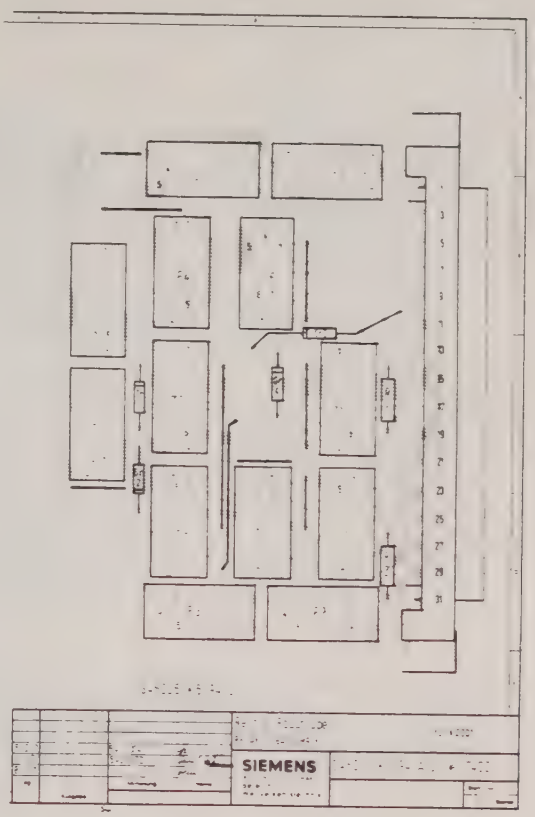
SIEMENS
LOGARITHMIC CONVERTER
S45035-K5098-A721-⊕-7402
S45035-K5098-UZ

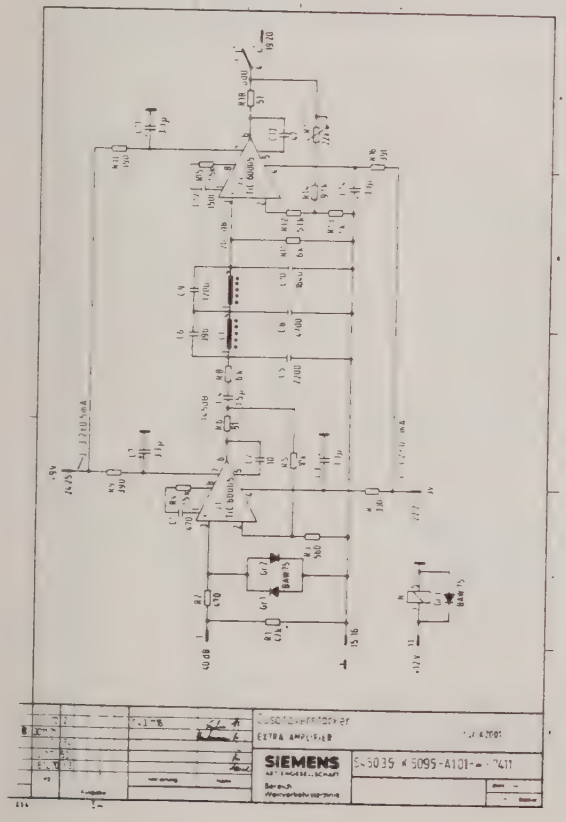
SIEMENS
S45035-K5098-A721-⊕-7402

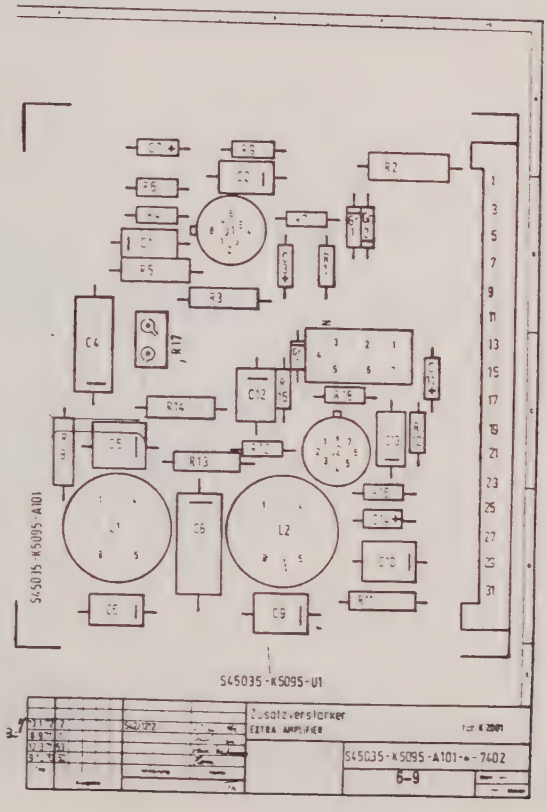

SIEMENS


SIEMENS
6-11


SIEMENS

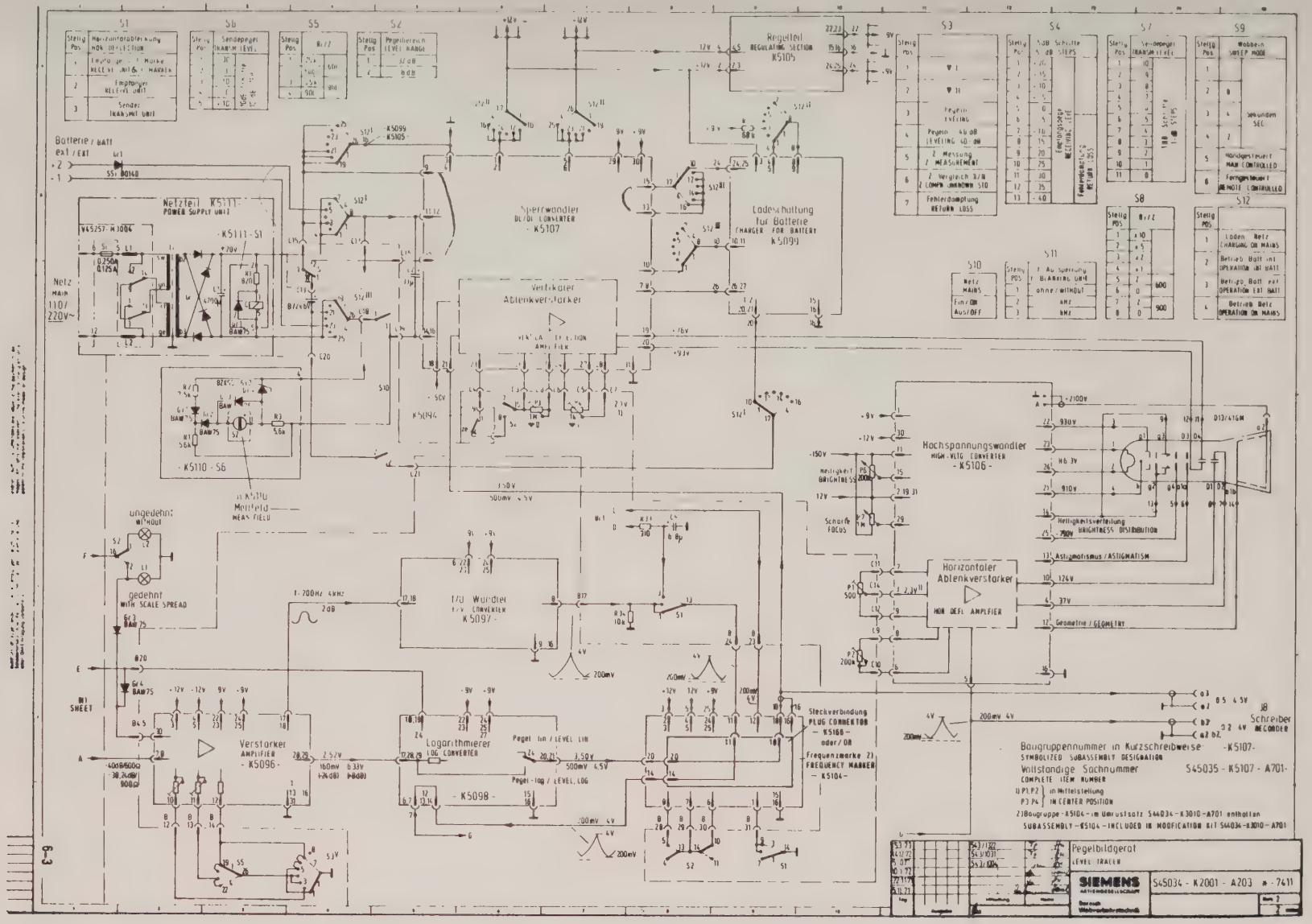

SIEMENS

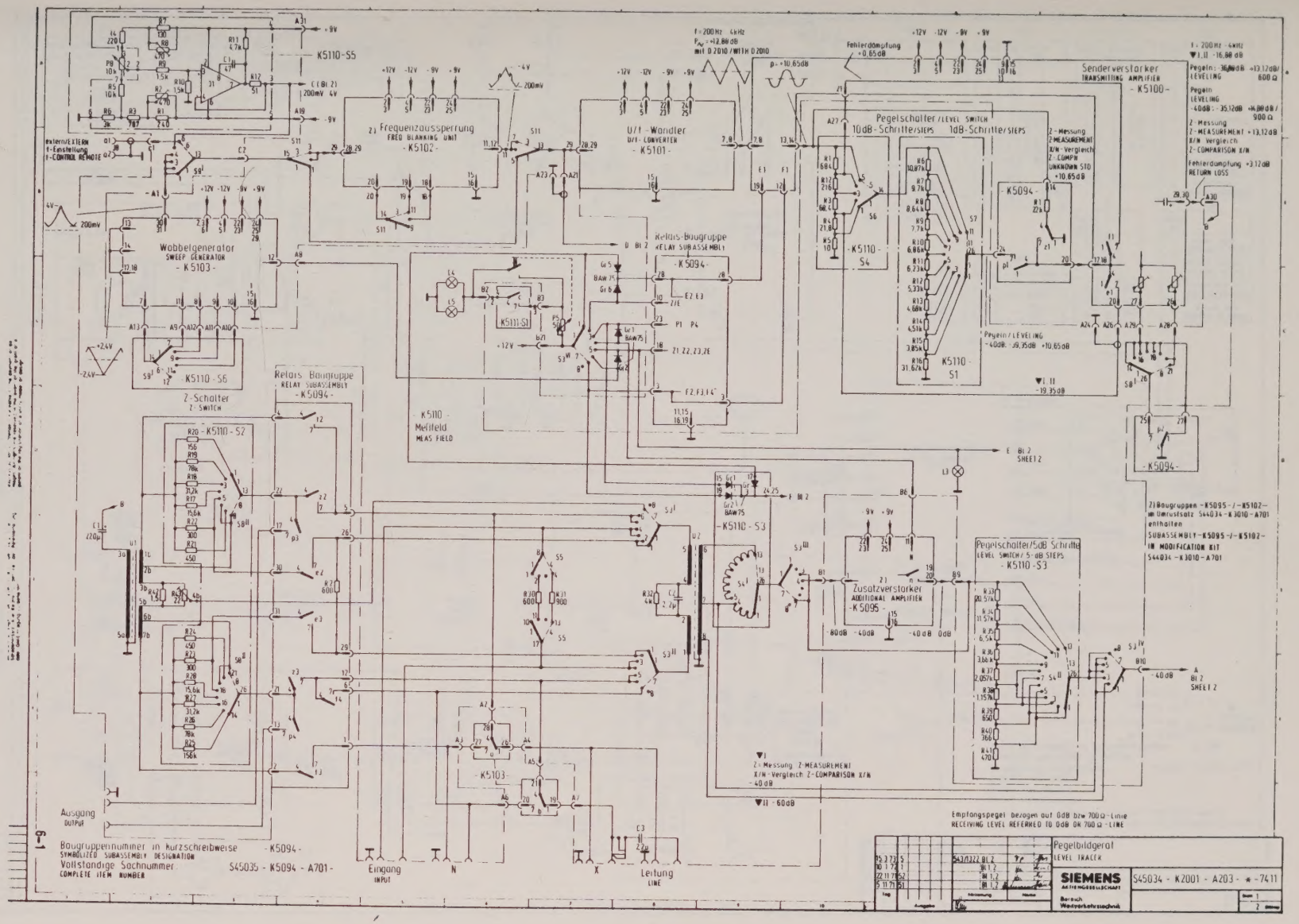

SIEMENS
S45035-K5095-A101-A-7411


S45035-K5095-A101
S45035-K5095-U1
S45035-K5095-A101-A-7402
6-9

SIEMENS

SIEMENS


Regelteil
REGULATING SECTION
K5105
Netzteil K5111
POWER SUPPLY UNIT
Sperrwandler
DC/DC CONVERTER
- K5107
Ladeschaltung für Batterie
CHARGER FOR BATTERY
K5094
Verstärker
Ablenkverstärker
VERTICAL DEFLECTION AMPLIFIER
Hochspannungswandler
HIGH-VLTG CONVERTER
- K5106 -
Horizontaler
Ablenkverstärker
HOR DEFL AMPLIFIER
Verstärker
AMPLIFIER
- K5096 -
Logarithmierer
LOG CONVERTER
- K5098 -
f/U Wandler
f/V CONVERTER
K5097
Pegelbildgerät
LEVEL TRACER
SIEMENS
S45034 - K2001 - A203 * - 7411


Senderverstärker
TRANSMITTING AMPLIFIER
- K5100 -
Pegelschalter/LEVEL SWITCH
10dB-Schritte/STEPS
1dB-Schritte/STEPS
- K5110 - S4
- K5110 - S1
- K5094 -
Pegelein/LEVEL
-40dB: -39,95dB +10,65dB
Frequenzaussperrung
FREQ BLANKING UNIT
- K5102 -
U/I-Wandler
U/I-CONVERTER
- K5101 -
Wobbelgenerator
SWEEP GENERATOR
- K5103 -
Relais-Baugruppe
RELAY SUBASSEMBLY
- K5094 -
- K5110 - S6
Z-Schalter
Z-SWITCH
- K5110 - S2
- K5110 - S3
Meßfeld
MEAS FIELD
Zusatzverstärker
ADDITIONAL AMPLIFIER
- K5095 -
Pegelschalter/5dB Schritte
LEVEL SWITCH/5-dB STEPS
- K5110 - S3
Ausgang
OUTPUT
Eingang
INPUT
Leitung
LINE
Pegelbildgerät
LEVEL TRACER
SIEMENS
S45034 - K2001 - A203 - * - 7411
Empfangspegel bezogen auf 0dB bzw 700Ω-Linie
RECEIVING LEVEL REFERRED TO 0dB OR 700Ω-LINE